Vol. 17, No. 7
July 1992

Energy Research Abstracts

Abstracts 17707–20632

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents. Please note that beginning with the January 1991 issue, *ERA* does not cover nonreport literature.

Scope

The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Doris M. Henline
Technical Editor, Robert W. Rutkowski

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada
Denmark
Finland
France
Federal Republic of Germany
Italy
Japan
The Netherlands
Norway
Spain
Sweden
Switzerland
United Kingdom
United States

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The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
9. **Number of pages** or page range. Prices are based on total pages unless special pricing applies.
10. **Language** of document if non-English.
11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
12. **Sponsoring organization.**
13. **Contract or grant number.**
14. **Secondary identifying number;** may be a conference number.
15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

① ② ③

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and**
deuterium polarized gas target for application in storage rings]:
④ **Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin ⑥
Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by ⑫
⑦ DOE Energy Research. DOE Contract FG02-88ER40438. Order ⑬
Number DE89007246. Available from NTIS, PC A03/MF A01 -
⑯ OSTI; GPO Dep. ⑰

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

⑨

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-**
like ions. Correlation effects. Vainshtejn, L.A. AN SSSR, Moscow.
⑧ Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical* ⑩
physics. Collection. Order Number DE89780060. Available from NTIS ⑪
(US Sales Only), PC A03/MF A01; INIS.
⑱ Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;... ⑳

⑨

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air**
pollution in house due to use of various fuels. Luo, Dayu (Chengdu ⑤
Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON
⑭ (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international ⑮
conference on indoor air quality and climate, Toronto (Canada), 29 Jul
- 3 aug 1990). In Indoor air '90: The fifth international conference on
indoor air quality and climate. Volume 1: Final report. 786p. Order ⑨
Number DE90017786. Source: NTIS.

⑲ Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in 30m^2 air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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INIS
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INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index

The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index

Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index

This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index

DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438	**Wisconsin Univ., Madison (USA). Dept. of Physics** 15:18494 DOE/ER/40438–T1
FG02-88ER60664	**Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index

Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438– T1	15:18494	NTIS, OSTI	E 1.99:	DE89007246	MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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  - 04 Processing
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  - 08 Waste Management
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  - 20 Transport, Handling, and Storage
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  - 03 Drilling, Fracturing, and Mining
  - 04 Oil Production, Recovery, and Refining
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  - 08 Economic, Industrial, and Business Aspects
  - 09 Waste Management
  - 10 Environmental Aspects
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  - 05 Uranium Enrichment
  - 07 Fuels Production and Properties
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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R1, *International Energy: Subject Categories and Scope.*

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03 Properties and Composition
04 Combustion
05 Transport, Handling, and Storage
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09 Environmental Aspects
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02 Site Geology and Meteorology
03 Plant Design and Operation
04 Legislation and Regulations
05 Economic, Industrial, and Business Aspects
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08 Health and Safety

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03 Economic, Industrial, and Business Aspects
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02 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
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24 Properties of Specific Particles and Resonances
30 Nuclear Physics
31 Nuclear Structure
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33 Nuclear Reactions and Scattering, General
34 Specific Nuclear Reactions and Scattering
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45 Special Atoms and Molecules
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51 Nuclear Techniques in Condensed Matter Physics
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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

0103 Preparation

Refer also to citation(s) 17741, 17800, 17816, 18656

17707 (CONF-911041–7) **Developing a coal quality expert: The prediction of ash deposit effects on boiler performance.** Thornock, D.E. (ABB/Combustion Engineering, Inc., Windsor, CT (United States)); Borio, R.W.; Mehta, A.K. ABB/Combustion Engineering, Inc., Windsor, CT (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89663. From 8. annual international Pittsburgh coal conference; Pittsburgh, PA (United States); 14-18 Oct 1991. Order Number DE92010149. Source: OSTI; NTIS; GPO Dep.

The overall objective of the Coal Quality Expert (CQE) Clean Coal I Program is the development of a Coal Quality Expert – a comprehensive PC based expert system for evaluating the potential for coal cleaning, blending and switching options to reduce emissions while producing the lowest cost electricity. A key part of the CQE model will be the development of a sub-model to predict the effects of ash deposition on boiler performance under various operating conditions. To facilitate sub-model development, a combination of full, pilot, and bench scale testing has been carried out on a series of coals and coal blends which were of interest to the Public Service of Oklahoma (PSO) at their Northeastern Station. A series of full-scale tests were also performed on PSO's Northeastern Unit #4 to characterize boiler performance when firing a "baseline coal" (their normal or desired fuel feed stock) and two blends comprised of the baseline coal blended with various amounts of an alternate coal. Actual furnace conditions were then closely matched during a series of tests performed in Combustion Engineering's pilot scale combustor, the Fireside Performance Test Facility (FPTF). Pilot scale testing allowed in-depth analyses of furnace deposits during and after formation under well-controlled conditions. Ash deposit properties were characterized during pilot scale furnace operation and in subsequent bench scale analyses. Determination of deposit behavior as a function of important operating parameters during the FPTF testing has permitted the prediction of expected performance for various coal/coal blends in PSO's Northeastern Units and allows a prediction of boiler performance for other units firing these fuels.

17708 (CONF-9110129–1) **New directions in DOE's Coal Preparation Program.** Hucko, R.E. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States). From 8. Korea-U.S. joint workshop on coal utilization technology; Seoul (Korea, Republic of); 28 Oct - 1 nov 1991. Order Number DE92011913. Source: OSTI; NTIS; GPO Dep.

In recent years, the US Department of Energy's Coal Preparation Program has concentrated on research related to reducing acid rain in precursor emissions. The focus of this work is to achieve deep pyritic sulfur removal from moderate- and high-sulfur bituminous coals using near-term physical coal preparation technologies; namely, selective agglomeration, advanced froth flotation, and advanced cycloning. With all components of the Acid Rain Control Initiative in place and scheduled for completion in 1993, two new major coal preparation initiatives are poised to get under way in 1992. The first, High-Efficiency Preparation, will develop the technology base for the efficient beneficiation, handling, and marketing of coal fines and will emphasize very low-cost and near-term approaches for sulfur removal beyond levels currently being attained. The second, Premium Fuel Applications, addresses new market opportunities for coal use. These opportunities require ultra-clean coals, thereby emphasizing both sulfur and ash removal. This paper describes progress that has been made under the Acid Rain Control Initiative and presents the rationale and objectives for the two new initiatives.

17709 (DOE/PC/79892–T18) **Development of the chemical and electrochemical coal cleaning process: Technical progress report, July 1, 1991–September 30, 1991.** Basilio, C.I.; Yoon, Roe-Hoan. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mining and Minerals Engineering. [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79892. Order Number DE92013184. Source: OSTI; NTIS; GPO Dep.

Liberation studies on the Elkhorn No. 3 coal were completed in this quarter. The results obtained from the 65 x 150 mesh samples showed that the amount of mineral matter and pyrite liberated by the Chemical and Electrochemical Coal Cleaning (CECC) process increases with time. The free mineral matter undergoes some reduction in size during the CECC treatment and the majority of the liberated mineral particles in this sample are finer than 150 mesh. This is opposite that found for the Pittsburgh No. 8 coal, which may explain the better response of the Elkhorn No. 3 coal to CECC treatment. The continuous bench-scale unit was modified during the quarter to satisfy the health and safety requirements of the university. The unit was modified to ensure that any spill or leakage can be contained. Due to these modifications, continuous testing work was delayed.

17710 (DOE/PC/79892–T19) **Development of the chemical and electrochemical coal cleaning process: Technical progress report, October 1, 1991–December 31, 1991.** Basilio, C.I.; Yoon, Roe-Hoan. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mining and Minerals Engineering. [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79892. Order Number DE92013353. Source: OSTI; NTIS; GPO Dep.

The continuous testing of the Chemical and Electrochemical Coal Cleaning (CECC) bench-scale unit (Task 6) was completed successfully in this quarter using Middle Wyodak and Elkhorn No. 3 coal samples. The CECC unit was run under the optimum conditions established for these coal samples in Task 4. For the Middle Wyodak coal, the ash content was reduced from 6.96% to as low 1.61%, corresponding to an ash rejection (by weight) of about 83%. The ash and sulfur contents of the Elkhorn No. 3 coal were reduced to as low as 1.8% and 0.9%. The average ash and sulfur rejections were calculated to be around 84% and 47%. The CECC continuous unit was used to treat -325 mesh Elkhorn No. 3 coal samples and gave ash and sulfur rejection values of as high as 77% and 66%. In these test, the clean -325 mesh coal particles were separated from the liberated mineral matter through microbubble column flotation, instead of wet-screening.

17711 (DOE/PC/88934–T11) **Enhancement of surface properties for coal beneficiation: Final report.** Chander, S.; Aplan, F.F. Pennsylvania State Univ., University Park, PA (United States). 30 Jan 1992. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88934. Order Number DE92011276. Source: OSTI; NTIS; GPO Dep.

This report will focus on means of pyrite removal from coal using surface-based coal cleaning technologies. The major subjects being addressed in this study are the natural and modulated surface properties of coal and pyrite and how they may best be utilized to facilitate their separation using advanced surface-based coal cleaning technology. Emphasis is based on modified flotation and oil agglomerative processes and the basic principles involved. The four areas being addressed are: (1) Collectorless flotation of pyrite; (2) Modulation of pyrite and coal hydrophobicity; (3) Emulsion processes and principles; (4) Evaluation of coal hydrophobicity.

17712 (DOE/PC/89789–T4) **Control of pyrite surface chemistry in physical coal cleaning: Technical progress report for the ninth quarter, September 1–November 30, 1991.** Yoon, R.H.; Luttrell, G.H.; Zachwieja, J.B.; Mielczarski, J.A. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). 18 Mar 1992. 23p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract FG22-89PC89789. Order Number DE92012561. Source: OSTI; NTIS; GPO Dep.

The separation of pyrite from coal by flotation is based on exploiting the wettability difference between coal and pyrite. There is evidence that the wettability of coal pyrite changes upon superficial oxidation. Therefore, the oxidation of coal pyrite has been studied under carefully controlled electrochemical conditions. In order to identify the species responsible for the changes in wettability, the surface products formed during oxidation have been identified by means of various surface analysis techniques, including X-ray photoelectron spectroscopy (XPS) and ion scattering spectroscopy (ISS). It has been found that pyrite oxidation creates a sulfur-rich surface along with iron oxides/hydroxides. The ratio between these hydrophobic and hydrophilic species correlates well with the results of the wettability measurements.

17713 (DOE/PC/91310–T1) **Use of solid-state NMR techniques for the analysis of water in coal and the effect of different coal drying techniques on the structure and reactivity of coal: Quarterly report, September 1–November 30, 1991.** Netzel, D.A. Western Research Inst., Laramie, WY (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91310. Order Number DE92010837. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this study are to develop an NMR method for measuring the water in coal, to measure the changes in coal structure that occur during coal drying, to determine what effect water has on retrograde/condensation reaction, and to determine the mechanism by which water any enhance coal reactivity toward liquefaction. Different methods of drying will be investigated to determine if drying can be accomplished without destroying coal reactivity toward liquefaction, thereby making coal drying an attractive and economical method for coal pretreatment. Coal drying methods will include thermal drying under different atmosphere and temperatures, drying with microwave radiation, and low-temperature chemical dehydration. The objectives for this quarterly report period were (1) to hire a student to help on the program, (2) to define the coals to be investigated and acquire the samples, (3) to order the necessary reagents and supplies, and (4) to conduct preliminary experiments for determining quantitatively using 2,2′-dimethoxypropane and ^{1}H NMR.

17714 (IS-T–1592) **Surface properties of coal and their effects on the selective oil agglomeration process.** Xiaoping, Qui. Ames Lab., IA (United States). 31 Mar 1992. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012586. Source: OSTI; NTIS; GPO Dep.

The overall purposes of this study were to establish practical methods for characterizing the surface hydrophobicity of coal and for measuring other interfacial properties involved in the oil agglomeration process, and to determine how these properties control the oil agglomeration process. It was hoped that this study would provide a better understanding of the mechanism of the oil agglomeration process in order to aid process optimization.

17715 (NEI-FI–153) **Intensifying of peat production by studying peat productions fundamentals: Final report.** Leinonen, A. (ed.). Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab. 1988. 292p. (In Finnish). Order Number DE92506476. Source: OSTI; NTIS (US Sales Only).

The research has been a start for the basic research of peat production. The aim of the research in the past has been to solve the everydays problems in production. The main target of the research has been to develop research equipments and to start the basic research. The emphasis in the research has been in peat drying, in peat cutting and in production control. Also it has been studied pneumatic harvesting. In peat drying-subtask it has been acquired the weather and soil simulator. It is possible to describe with this equipment peat soil and weather conditions. It has been studied the effect of the thickness of milling layer and the ground water level to peat drying in changing and constant weather conditions and also sudied energy- and heatbalance in peat drying layer. In peat cutting-subtask it has been acquired milling simulator, by which it is possible to study the effect of the soil and technical parameters to grain size of milling layer and to the power need of the miller. It has been made experiments with the screw miller in connection with to get the experiment equipment into operation. In production control-subtask it has been developed the small-sod peat production control system and better and more precise milled peat production control system. In pneumatic harvesting-subtask the main results were, that the flowrates in the nozzles and in the the canals changed very much, the dust emissions were smaller with light humified peat than with well humified peat, there was not difference in produced peat with little and well humified meat and the measuring of weight of pneumatic harvester would realize by measuring the pressure of hydraulics.

17716 (VTT-OPT–37) **The research of bog hydrology for the intensifying solar peat drying.** Jaervinen, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Nov 1991. 48p. (In Finnish). Project KTM-275/881/87. Order Number DE92506479. Source: OSTI; NTIS (US Sales Only).

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The aim of this research was to improve the peatland drainage for peat production, to understand peat field hydrology more accurately, to create new measuring methods for the moist layer and the water table in the field, and to test low level mole drainage. Primarily the peat type and quality determine the moisture content of a peat layer in a production field. The Sphagnum peat can maintain the moist layer 10-20 cm higher than the Carex peat, which has a smaller particle size distribution than Sphagnum peat, and the decomposition increases the difference. The density of Carex peat surface increases more easily. The Sphagnum peat field can bear the machinery even when the water table is higher due to fibrous matter content of it. With Carex peat the water table and actual capillary fringe can not be very close to the field surface because the bearing capacity of the peat is low. The unsaturated layer is thick in peat production field, and it has to thicker than in a peatland forestry, there it is called the deficit store. The ground(bog) water cooling and heating effect in summer and winter (frost) time can very easily be determined by temperature measurements. The temperature conditions under daily cycle are remarkably stable and predictable, which means the possibility of measuring any anomalities by temperature difference. It also enables the measurement of water table, the rising of it, and propably provides also a great deal of information such as peat and field quality, evaporation, rain infiltration, drainage, etc. The temperature measurement is also connected easily with a radio-= wave probe and other bog surveying instruments. The ditch bottom should be under the water table in order to function well. Roughness and holes in the surface of a peat field actually enables better infiltration and filling of the unsaturated layer.

17717 (VTT-OPT–39) **The effect of weather on the moisture content of milled peat.** Heikinheimo, M. (Finnish Meteorological Inst., Helsinki (Finland)); Koskela, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Dec 1991. 29p. (In Finnish). Project KTM-275/881/87. Order Number DE92506481. Source: OSTI; NTIS (US Sales Only).

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The model 'DRYPEAT', developed in this study, simulates the cahnges in the moisture content of a milled peat layer thus giving an estimate of the progress and length of a harvest run. The model, which is proposed for operational use in peat harvesting, was derived using the simulation results of a detailled physical model and weather data measured at the Hoeystoesensuo production site. The forcing variable used in this model is potential evaporation. The key variable of the model was the drying efficiency defined as the ratio of the change per unit time in the water content of the milled peat layer and the rate of potential evaporation. The drying efficiency depended non-linearly on the volume moisture content and linearly on the layer thickness of the milled peat. The physical model, the DRYPEAT model and the gravimetric measurements of the moisture content gave similar and realistic results on the progress of the harvest run. As the DRYPEAT model was calibrated agains the physical model, the results of the two models were quite similar. The future development of the DRYPEAT model lies on the improvements in the parametrization of the physical model. The emphasis in this study was to evaluate the effects of layer thickness of the milled layer on the drying time. Increasing layer thickness from 20 to 30 mm increased the drying time (from 70 % moisture content to 40 %) from 22 hours to 32 hours or 1.5 fold under the constant rate of 0.4 mm/h potential evaporation. Increasing the layer thickness from 20 mm to 40 mm the drying time doubled.

17718 (VTT-OPT--40) **A method for estimating the climatological potential of peat production.** Heikinheimo, M. (Finnish Meteorological Inst., Helsinki (Finland)); Koskela, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Dec 1991. 39p. (In Finnish). Project KTM-275/881/87. Order Number DE92506482. Source: OSTI; NTIS (US Sales Only).

OPTIMITURVE Research Programme.

The climatological potential of peat production was assessed by using the synoptic weather stations of the Finnish Meteorological Institute and applying the model DRYPEAT for the simulation of moisture content of milled peat. The forcing variables in the model were three hourly potential evaporation and rainfall derived from synoptic weather records. The model calculated the progress of drying or wetting of the milled peat and estimated the length of the periods when there was no production due to excess moisture in the soil. The model parameters, given for the simulation, were the initial (70 % kg/kg) and final (40 % kg/kg) water content of each harvest run, dry matter density (100 kg/m3) and layer thickness (30 mm) of milled peat. The climatological potential of peat production was measured as the number of harvest runs within the period concidered. The highest climatological potential appeared in the south-eastern and south-western production areas of Finland, where on average 24 harvest runs were counted. Relatively favourable were also the coastal regions of Bothnia, Northern Savo and Northern Karelia. In the Suomenselkae ridge region, there the climate is relatively cool and moist the average accumulation of harvest runs was only 15. The number of harvest runs varied greatly both in space and in time. The average local difference in climatological potential between warm/dry and cool/rainy summers was 10 harvest runs.

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Refer also to citation(s) 17709, 17710, 17800, 17822, 18274, 18278, 18656

17719 (CONF-910852--20) **Competitive reactions for the study of catalytic liquefaction.** Schroeder, K.; Bockrath, B.; Miller, R.; Davis, H. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). From Summer national meeting of the American Institute of Chemical Engineers (AIChE); Pittsburgh, PA (United States); 20-22 Aug 1991. Order Number DE92011912. Source: OSTI; NTIS; GPO Dep.

The present work describes experiments in which the model compound 1-ethylnaphthalene (1-ETN) was reacted in the presence of both catalyst and coal. The objective was to study the activity of the molybdenum sulfide catalyst formed in the presence of coal using reactions of mechanistic interest. The amount of the model compound was kept low to reduce the effect of its presence on the reaction environment. Thus, 1-ETN can be considered to be a "probe" or "reporter" molecule. Ammonium tetrathiomolybdate was used as a catalyst precursor, and is known to form molybdenum disulfide under our reaction conditions. The disulfide is thought to be the active catalyst. Argonne Premium Illinois No. 6 coal was used to provide the processing environment. No effort was made to disperse the catalyst on the coal.

17720 (CONF-910902--14) **Catalyzed hydrogen/deuterium exchange reactions on coal.** Bockrath, B.C.; Solar, J.M.; Bittner, E.W.; Hough, M.R. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). From 1991 international conference on coal science; Newcastle upon Tyne (United Kingdom); 16-20 Sep 1991. Order Number DE92011750. Source: OSTI; NTIS; GPO Dep.

A study was initiated in this laboratory to investigate the exchange of deuterium gas with the hydrogen on coal and to determine whether a dispersed catalyst could play a role in this reaction. A pulse-flow microreactor was constructed that permits the study of mixtures of coal and catalyst as they are heated in a tubular furnace. Pulses of deuterium gas were carried through the bed of coal by a stream of argon. The products were analyzed by a quadrupole mass spectrometer. The results of this work demonstrated that MoS_2 will catalyze the exchange reaction at temperatures as low as 225°C physically mixed with coal.

17721 (CONF-910902--15) **Modeling coal chemistry: One electron catalytic reactions.** Farcasiu, M. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Smith, C.; Hunter, E.A. Oak Ridge Associated Universities, Inc., TN (United States); USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. From 1991 international conference on coal science; Newcastle upon Tyne (United Kingdom); 16-20 Sep 1991. Order Number DE92011745. Source: OSTI; NTIS; GPO Dep.

The complexity of the coal structure, in general, and of its organic part, in particular, prevents a rigorous study of coal chemistry. The use of model compounds with less complicated chemical structures to model specific reactions relevant to coal transformation into useful products is necessary and helpful. This is true, however, only if the modeling is properly applied and especially if the results are not excessively extrapolated to all aspects of coal reactivity. The emphasis on all catalytic routes in coal liquefaction has enhanced the interest in the study of the chemistry involved in heterogeneous catalytic reactions relevant to the first stage, solubilization, of coal. One of the important reactions associated with this first stage is the cleavage of carbon-carbon bonds linking aromatic rings with aliphatic moieties. In previous publications (1,2,3) we have used a model compound 4-(1-naphthylmethyl)bibenzyl (1) in which the bond linking the naphthalene ring to a methylene carbon can be selectively cleaved by specific catalysts (i.e. carbon materials, some iron catalysts) at temperatures at which thermal, free radical-initiated reactions, do not take place. Our data suggest that the above-mentioned catalytic cleavage is initiated by the ion radical of 1, with the unpaired electron localized in the naphthalene ring.

17722 (CONF-911041--6) **The effect of CO_2 and H_2O and their interaction in a novel slurry phase synthesis of methanol.** Palekar, V.M.; Liu, Zhenyu; Shah, Y.T.; Tierney, J.W.; Wender, I. Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering. [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89786. From 8. annual international Pittsburgh coal conference; Pittsburgh, PA (United States); 14-18 Oct 1991. Order Number DE92011253. Source: OSTI; NTIS; GPO Dep.

Experimental results on the influence of CO_2 and H_2O in a novel liquid phase "concurrent" synthesis of methanol are presented. The synthesis carried out in a single reactor under mild conditions ($T = 150°C$; $P = 910$ psig) likely involves the carbonylation of methanol to methyl formate followed by the hydrogenolysis of the methyl formate to two molecules of methanol; the net result is the hydrogenation of CO to give methanol. Carbon dioxide is not an intermediate in this system. The tolerance of the alkali methoxide/Cu-chromite catalyst system to CO_2 and H_2O will be discussed.

17723 (CONF-920444--23) **Coprocessing of coal and waste rubber.** Farcasiu, M. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Smith, C.M. Oak Ridge Associated Universities, Inc., TN (United States); USDOE Pittsburgh Energy Technology Center, PA (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92011746. Source: OSTI; NTIS; GPO Dep.

The disposal of used tires, the main source of waste rubber, is an important environmental problem. We describe a method to transform used rubber tires into useful liquid products by coprocessing them with coal. Carbon black, an important constituent in rubber tires, provides a good hydrocracking catalyst during coprocessing. Due to the presence of carbon black in the rubber tires, the yields of liquids obtained by coal-rubber tires coprocessing are superior to those that could be obtained by coprocessing rubber with coal in the absence of carbon black.

17724 (CONF-920444-28) **Reactivity of coals under coprocessing conditions.** Tomic, J.; Schobert, H.H. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88935. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92013222. Source: OSTI; NTIS; GPO Dep.

In the recent years greater interest has developed for processes involving coal and petroleum fractions to produce distillate fuels. Coprocessing is especially attractive as a direct liquefaction process because it involves the use of heavy petroleum fractions, so both coal and heavy petroleum resids are upgraded simultaneously. The main distinction of coprocessing from other direct liquefaction processes is that coprocessing is more complex from a chemical standpoint than direct liquefaction processes which use traditional solvents, due to the greater variety of hydrocarbons (aromatic from the coal and aliphatics from the petroleum) present in the system. Therefore, need arises for better understanding of the chemical and physical interactions during coprocessing. The aim of the present study is to examine the influence of reaction conditions, coal and petroleum resid properties as well as the compatibility of the coal/petroleum resid pairs in terms of structural components on total coal conversion. Special focus will be given to the reactivity of coals and interaction of the coal and resid which lead to anisotropic coke.

17725 (CONF-920560-1) **The chemical modification of enzymes to enhance solubilization and activity in organic solvents for interaction with coal.** Scott, C.D.; Scott, T.C.; Woodward, C.A. Oak Ridge National Lab., TN (United States). 30 Mar 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. international symposium on the biological processing of coal; Clearwater, FL (United States); 4-7 May 1992. Order Number DE92011686. Source: OSTI; NTIS; GPO Dep.

Some enzymes can effectively function as catalysts in contact with organic solvents in a variety of ways; however, it is desirable to utilize the enzyme in a soluble form for interactions with a solid substrate such as coal. Chemical modification of the enzyme to increase hydrophobicity is one way to increase organic solubilization while maintaining catalytic activity. An effective technique is to add dinitrophenyl groups to the protein molecule, thus, making it much less polar and more hydrophobic. Dinitrofluorobenzene (DNFB) is being used as the reagent to add dinitrophenyl groups to enzymes. Such modified enzymes have solubilities up to 20 mg/mL in organic solvents ranging from dioxane to benzene. Mixed reducing enzymes modified by DNFB and used in pyridine or benzene under a hydrogen atmosphere have been shown to significantly enhance the liquefaction of coal ranging from lignite to bituminous with up to 29.6% coal conversion. A fluidized-bed bioreactor appears to be the most effective contractor.

17726 (CRIE-W-90017) **Development of high-performance coal gasification technology for high ash fusion point coals by coal blending method.: Behavior of coal ash fusion temperature and gasification characteristics.** Inumaru, J. (Central Reserach Institute of Electric Power Industry, Tokyo (Japan)); Hara, S.; Ashizawa, M.; Hamamatsu, T.; Takekawa, T.; Koyama, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Feb 1991. 34p. (In Japanese). Order Number DE92514551. Source: OSTI; NTIS (US Sales Only).

In the entrained bed coal gasification method it is necessary to fuse and remove ash in coal, so the higher an ash fusion point of the coal is, the higher a temperature in the coal gasifier should be kept. Therefore, the amount of air into the gasifier is increased. Naturally performance of the gasifier tends to be lowered. At present, about 50% of imported coals for electric power use are high ash fusion point coals. To commercialize this coal gasification method, it is important to develop technology for gasifying high ash fusion point coals at high performance by flux addition, coal blending, etc. This paper studies behaviors of ash fusion point lowering by coal blending using high ash fusion point coal and low ash fusion point coal and basic characteristics of coal blending gasification in a 2T/D coal gasifier. As a result, it is found that it is possible to substantially lower the ash fusion point (approximately 350°C or more) by coal blending. Moreover, from results of the bench-scale gasification in the 2T/D gasifier, it is clarified that slag of high ash fusion point coal is reduced by coal blending, improvement of gasification performance becomes possible by reducing the amount of air into the gasifier, and settlement of the appropriate coal blending ratio improves operational performance. 8 refs., 20 figs., 11 tabs.

17727 (CRIE-W-90022) **Development of high-performance coal casification technology for high ash fusion temperature coals by flux addition method.: Behavior of coal ash fusion temperature drop and casification characteristics.** Ashizawa, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Inumaru, J.; Hara, S.; Hamamatsu, T.; Takekawa, T.; Koyama, Y. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1991. 35p. (In Japanese). Order Number DE92514553. Source: OSTI; NTIS (US Sales Only).

In the coal gasifier developed by Central Research Institute Electric Power Industry (CRIEPI), the higher an ash fusion point of the coal is, the higher a temperature in the gasifier should be kept. Therefore, the gasifier has to be so operated that the amount of air into the gasifier is increased. Resultantly, it tends to cause lowering of calorie of gas product. To commercialize CRIEPI's entrained bed coal gasification system, it is important to develop a flux (fusion point lowering agent) addition technology for gasifying even high ash fusion point coals at high performance. This paper studies behaviors of coal ash fusion point lowering and characteristics of gasification in a 2T/D gasifier by flux addition using Australian BL, UL and BW coals. The result shows that a large drop (300 °C) of the ash fluid temperature of each coal is possible by flux (CaO) addition. Also, from the result of the flux addition gasification test, it is found that slag becomes easy to flow out and calorie of gas product is improved by operation with a lower air ratio. 10 refs., 26 figs., 6 tabs.

17728 (CRIE-W-90031) **Study of optimum filter size for large scale filtration equipment in IGCC power generation system.** Ito, S. (Central Reserach Institute of Electric Power Industry, Tokyo (Japan)); Tanaka, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Apr 1991. 27p. (In Japanese). Order Number DE92514555. Source: OSTI; NTIS (US Sales Only).

Large-scaling of porous filter dust collection equipment has been needed for design of a pilot plant and a commercial plant of the dry fixed bed gas cleaning system. The paper investigates a method to select an adequate filter size which is employed to such large-scaled dust collection equipment. For selection of the filter size, flow simulation in the filter is conducted so that pressure and flux distribution in the filter can be calculated at the time of dust collection and back washing. The size of the large-scale filter is restricted mainly by the back wash condition. The larger the filter is and the smaller the diameter is, the higher the total pressure of the back wash gas should be. The smaller the diameter of the filter is and the longer the filter is, the higher the flow velocity of the back wash gas into the filter becomes. So, this sometimes causes problems on vibration, strength of fitting, etc. To avoid excess flow velocity into the filter while keeping the back wash effect, the filter diameter is restricted according to the filter diameter. 6 refs., 19 figs., 1 tab.

17729 (CRIE-W-90032) **Evaluation of performance stability of desulfurization sorbent for coal gas.: Characteristics of desulfurization/regeneration repetition under pressurized conditions.** Kobayashi, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Shirai, Y.; Nakayama, T.; Tanaka, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). May 1991. 21p. (In Japanese). Order Number DE92514556. Source: OSTI; NTIS (US Sales Only).

For commercialization of the fixed bed desulfurization system used for the integrated coal gasification combined cycle power generation, required is long-term stabilization of performance of desulfurizing agent. Since iron oxide based honeycomb desulfurizing agent is used repeatedly in this system, the system conducts removal of sulfur in coal gas (desulfurization), discharge of sulfur in desulfurizing agent (regeneration) and then preparation of desulfurization (reduction). In a test on repeated use of desulfurizing agent carried out under practical operation condition (pressurizing), stabilization of the performance is demonstrated and also a relation between absorbed sulfur and sulfur undischarged by regeneration and reduction (residual sulfur) is examined. Variations of the performance of desulfurizing agent are studied by changes of sulfur compound concentration (breakthrough curves) at the outlet at the time of desulfurizing. Breakthrough curves show almost the same curves on or after 10 cycles of repetition and the performance becomes stabilized. It is found that absorbed sulfur is influenced only by the residual sulfur after the performance is stabilized. 6 refs., 10 figs., 3 tabs.

17730 (DOE/MC/11076–3061) **Results of Phase 2 postburn drilling, coring, and logging: Rocky Mountain 1 Underground Coal Gasification Test, Hanna, Wyoming.** Oliver, R.L.; Lindblom, S.R.; Covell, J.R. Western Research Inst., Laramie, WY (United States). Feb 1991. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE92001142. Source: OSTI; NTIS; GPO Dep.

The Rocky Mountain 1 (RM1) Underground Coal Gasification (UCG) site consisted of two different module configurations: the controlled retracting injection point (CRIP) and elongated linked well (ELW) configurations. The postburn coring of the RM1 UCG site was designed in two phases to fulfill seven objectives outlined in Western Research Institute's Annual Project Plan for 1989 (Western Research Institute 1989). The seven objectives were to (1) delineate the areal extent of the cavities, (2) identify the extent of roof collapse, (3) obtain samples of all major cavity rock types, (4) characterize outflow channels and cavity stratigraphy, (5) characterize the area near CRIP points and ignition points, (6) further define the structural geology of the site, and (7) identify the vertical positioning of the horizontal process wells within the coal seam. Phase 1 of the coring was completed during the summer of 1989 and served to partially accomplish all seven objectives. A detailed description of Phase 1 results was presented in a separate report (Lindblom et al. 1990). Phase 2, completed during the summer of 1990, was designed to complete the seven objectives; more specifically, to further define the areal extent and location of the cavities, to evaluate the outflow channels for both modules, and to further characterize the structural geology in the ELW module area.

17731 (DOE/MC/11076–3062) **Hoe Creek 1990 quarterly sampling cumulative report.** Crader, S.E.; Huntington, G.S. Western Research Inst., Laramie, WY (United States). Mar 1991. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE92001143. Source: OSTI; NTIS; GPO Dep.

Groundwater samples were collected and analyzed for benzene and for total phenols three times during 1990. This report summarizes the results of these sampling events and compares the results with those obtained in previous years. Possible further options for remediation of the Hoe Creek site was addressed. Three underground coal gasification (UCG) burns were performed by Lawrence Livermore National Laboratory for the US Department of Energy in 1976, 1977, and 1979 at the Hoe Creek site, which is about 20 miles south of Gillette, Wyoming. As a result of these burns, there has been considerable contamination of groundwater by various organic compounds. There have been three efforts at remediating this situation. In 1986 and again in 1987, contaminated water was pumped out, treated, and reinjected. In 1989, the water was pumped, treated, and sprayed into the atmosphere. Benzene and total phenols have been monitored at various monitoring wells as the site during 1990. The highest detected benzene concentration in 1990 was 220 μg/L, and the highest total phenols concentration was 430 μg/L. It is apparent that contamination is still above baseline levels, although the concentration of total phenols is far less than immediately after the burns. The burned coal seams are still releasing organic compounds into the groundwater that passes through them.

17732 (DOE/MC/23075–3079) **Measurement and modeling of advanced coal conversion processes: Twenty-first quarterly report, October 1, 1991–December 31, 1991.** Solomon, P.R. (Advanced Fuel Research, Inc., East Hartford, CT (United States)); Serio, M.A.; Hamblen, D.G.; Smoot, L.D.; Brewster, B.S. Advanced Fuel Research, Inc., East Hartford, CT (United States); Brigham Young Univ., Provo, UT (United States). 1991. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC23075. Order Number DE92012186. Source: OSTI; NTIS; GPO Dep.

The objective of this study are to establish the mechanisms and rates of basic steps in coal conversion processes, to integrate and incorporate this information into comprehensive computer models for coal conversion processes, to evaluate these models and to apply them to gasification, mild gasification and combustion in heat engines.

17733 (DOE/MC/23075–3081) **Measurement and modeling of advanced coal conversion processes: Annual report, October 1990–September 1991.** Solomon, P.R. (Advanced Fuel Research, Inc., East Hartford, CT (United States)); Serio, M.A.; Hamblen, D.G.; Smoot, L.D.; Brewster, B.S. Advanced Fuel Research, Inc., East Hartford, CT (United States); Brigham Young Univ., Provo, UT (United States). [1991]. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC23075. Order Number DE92001267. Source: OSTI; NTIS; GPO Dep.

The overall objective of this program is the development of predictive capability for the design, scale up, simulation, control and feedstock evaluation in advanced coal conversion devices. This program will merge significant advances made in measuring and quantitatively describing the mechanisms in coal conversion behavior. Comprehensive computer codes for mechanistic modeling of entrained-bed gasification. Additional capabilities in predicting pollutant formation will be implemented and the technology will be expanded to fixed-bed reactors.

17734 (DOE/MC/24266–3069-Vol.2) **Development of an advanced, continuous mild gasification process for the production of co-products (Tasks 2, 3, and 4.1 to 4.6), Volume 2: Final report.** Knight, R.A. (Institute of Gas Technology, Chicago, IL (United States)); Gissy, J.L.; Onischak, M.; Babu, S.P.; Carty, R.H.; Duthie, R.G.; Wootten, J.M. Institute of Gas Technology, Chicago, IL (United States). Sep 1991. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC24266. Order Number DE92001251. Source: OSTI; NTIS; GPO Dep.

Volume 2 contains information on the following topics: (1) Mild Gasification Technology Development: Process Research Unit Tests Using Slipstream Sampling; (2) Bench-Scale Char Upgrading Study; (3) Mild Gasification Technology Development: System Integration Studies. (VC)

17735 (DOE/MC/24268–3075) **Development of an advanced continuous mild gasification process for the production of coproducts: Task 4, Mild gasification tests.** Merriam, N.W.; Cha, C.Y.; Kang, T.W.; Vaillancourt, M.B. Western Research Inst., Laramie, WY (United States). Dec 1990. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC24268. Order Number DE92001261. Source: OSTI; NTIS; GPO Dep.

Western Research Institute (WRI) teamed with the AMAX Research and Development Center and Riley Stoker Corporation on Development of an Advanced, Continuous Mild-Gasfication Process for the Production of Coproducts under contract DE-AC21-87MC24268 with the Morgantown Energy Technology of the US Department of Energy. The strategy for this project is to produce electrode binder pitch and diesel fuel blending stock by mild gasification of Wyodak coal. The char is upgraded to produce anode-grade carbon, carbon black, and activated carbon. This report describes results of mild-gasification tests conducted by WRI. Char upgrading tests conducted by AMAX will be described in a separate report.

17736 (DOE/MC/25003–3045) **Enhanced durability of high-temperature desulfurization sorbents for moving-bed applications: Base Program: Development and testing of zinc ferrite sorbents.** Ayala, R.E. General Electric Co., Schenectady, NY (United States). Corporate Research and Development Center. Aug 1991. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25003. Order Number DE92001121. Source: OSTI; NTIS; GPO Dep.

The objective of this contract was to identify and test fabrication methods and sorbent chemical compositions that enhance the long-term chemical reactivity and mechanical strength of zinc ferrite and other novel sorbents for moving-bed, high-temperature desulfurization of coal-derived gases. Desired properties to be enhanced for moving-bed sorbent materials are: (1) high chemical reactivity (sulfur absorption rate and total sulfur capacity), (2) high mechanical strength (pellet crush strength and attrition resistance), and (3) suitable pellet morphology (e.g., pellet size, shape, surface area, and average specific pore volume). In addition, it is desired to maintain the sorbent properties over extended cyclic use in moving- bed systems.

17737 (DOE/MC/25006–3057) **A preliminary study of carbon deposition on zinc ferrite sorbents: Topical report for Task 9.** Krishnan, G.N. (SRI International, Menlo Park, CA (United States)); Wong, V.K.; Wood, B.J. Research Triangle Inst., Research Triangle Park, NC (United States); SRI International, Menlo Park, CA (United States). Aug 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25006. Order Number DE92001138. Source: OSTI; NTIS; GPO Dep.

A preliminary study was conducted to determine the feasibility of cumulative carbon deposition on zinc ferrite sorbents under conditions relevant to desulfurization of hot coal gas from the KRW fluidized bed gasifier operating in the air-blown mode. Thermodynamic calculations indicated that the range of conditions under which carbon deposition and carbide formation occur can be broadened if the gas contains less than equilibrium levels of methane. These calculations also indicated that dissociation of CO and reduction of CO by hydrogen are potential pathways for carbon deposition on the sorbent.

17738 (DOE/PC/79816–T3) **An innovative catalyst system for slurry-phase Fischer-Tropsch synthesis: Cobalt plus a water-gas-shift catalyst: Final technical report.** Satterfield, C.N.; Yates, I.C.; Chanenchuk, C. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Chemical Engineering. Jul 1991. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79816. Order Number DE92011275. Source: OSTI; NTIS; GPO Dep.

The feasibility of using a mechanical mixture of a $Co/MgO/SiO_2$ Fischer-Tropsch catalyst and a $Cu\text{-}ZnO/Al_2O_3$ water-gas-shift (WGS) catalyst for hydrocarbon synthesis in a slurry reactor has been established. Such a mixture can combine the superior product distribution from cobalt with the high activity for the WGS reaction characteristic of iron. Weight ratios of $Co/MgO/SiO_2$ to $Cu\text{-}ZnO/Al_2O_3$ of 0.27 and 0.51 for the two catalysts were studied at 240°C, 0.79 MPa, and in situ H_2/CO ratios between 0.8 and 3.0. Each catalyst mixture showed stable Fischer-Tropsch activity for about 400 hours-on-stream at a level comparable to the cobalt catalyst operating alone. The $Cu\text{-}ZnO/Al_2O_3$ catalyst exhibited a very slow loss of activity under these conditions, but when operated alone it was stable in a slurry reactor at 200–220°C, 0.79–1.48 MPa, and H_2/CO in situ ratios between 1.0 and 2.0. The presence of the water-gas-shift catalyst did not affect the long-term stability of the primary Fischer-Tropsch selectivity, but did increase the extent of secondary reactions, such as l-alkene hydrogenation and isomerization.

17739 (DOE/PC/79818–T5) **Bench-scale co-processing: Quarterly report No. 11, October 1, 1990–December 31, 1990.** Piasecki, C.A.; Gatsis, J.G. UOP, Inc., Des Plaines, IL (United States). 19 Feb 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79818. Order Number DE92012555. Source: OSTI; NTIS; GPO Dep.

The objective of this contract is to extend and optimize UOP's single-stage, slurry-catalyzed co-processing scheme. The particular emphasis is one evaluating alternative and disposable slurry-catalyst systems. During the current quarter, Lloydminster vacuum resid was processed without the presence of coal. The objective of this study was to evaluate the manner in which the resid is upgraded at high-severity conditions to help understand the function of the resid during co-processing. This report coves Bench-Scale Runs 30 to 34. In Runs 30 to 34, Lloydminster vacuum resid was processed without the presence of coal using a 0.05 wt % molybdenum-based catalyst at 465°C.

17740 (DOE/PC/79818–T7) **Bench-scale co-processing: Quarterly report No. 13, April 1, 1991–September 31, 1991.** Piasecki, C.A.; Gatsis, J.G. UOP, Inc., Des Plaines, IL (United States). 19 Feb 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79818. Order Number DE92012557. Source: OSTI; NTIS; GPO Dep.

The objective of this contract is to extend and optimize UOP's single-stage, slurry-catalyzed co-processing scheme. The current task is to complete a long-term operability run using a 0.05 wt-% Mo-based catalyst at approximately 460°C. The objectives of this run are to demonstrate that high-severity conditions can be run for an extended period of time (at least one month) and to collect enough product sample to do a complete Hempel fractionation and detailed characterization of the individual naphtha, distillate, and VGO cuts. This information will be used to reevaluate the engineering design and product upgrading scheme that was developed under the first co-processing contract (DE-AC22-84PC70002). During the current two quarters, the long-term operability study was unsuccessfully attempted several times. This report discusses these attempts.

17741 (DOE/PC/79892–T16) **Development of the chemical and electrochemical coal cleaning process: First quarterly technical progress report, April 1, 1988–June 30, 1988.** Yoon, R.H. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mining and Minerals Engineering. [1988]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79892. Order Number DE92013373. Source: OSTI; NTIS; GPO Dep.

The objectives of this effort are (a) to learn the mechanisms by which the Chemical and Electrochemical Coal Cleaning (CECC) process removes pyritic sulfur and ash from coal, (b) to learn more about the operating parameters of the process, (c) to collect engineering information for scale-up of the process, and (d) to test the CECC process on a bench-scale continuous operation.

17742 (DOE/PC/79912–17) **Thiophene metabolism by E. coli: Final technical report, September 15, 1987–December 31, 1991.** Clark, D.P. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Microbiology. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-87PC79912. Order Number DE92011274. Source: OSTI; NTIS; GPO Dep.

The objective for this project was to continue the genetic analysis of the thiophene oxidation system, in particular: 1. characterization of the biochemical pathway for thiophene oxidation, 2. identification and mapping of any further genes involved in thiophene degradation, 3. analysis of how the thd genes are regulated, and 4. cloning and sequencing of at least some of the thd genes.

17743 (DOE/PC/80016–T10) **Improved Fischer-Tropsch catalysts for indirect coal liquefaction: Final report.** Wilson, R.B. Jr.; Tong, G.T.; Chan, Y.W.; Huang, H.W.; McCarty, J.G. SRI International, Menlo Park, CA (United States). Feb 1989. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-85PC80016. Order Number DE92010947. Source: OSTI; NTIS; GPO Dep.

The Fischer-Tropsch synthesis (FTS)reaction is the established technology for the production of liquid fuels from coal by an indirect route using coal-derived syngas ($CO + H_2$). Modern FTS catalysts are potassium- and copper-promoted iron preparations. These catalysts exhibit moderate activity with carbon monoxide-rich feedstocks such as the syngas produced by advanced coal gasification processes. However, the relatively large yields of by-product methane and high-molecular-weight hydrocarbon waxes detract from the production of desired liquid products in the C_5-C_{16} range needed for motor and aviation fuel. The goal of this program is to decrease undesirable portions of the FTS hydrocarbon yield by altering the Schultz-Flory polymerization product distribution through design and formulation of improved catalysts. Two approaches were taken: (1) reducing the yield of high-molecular-weight hydrocarbon waxes by using highly dispersed catalysts produced from surface-confined multiatomic clusters on acid supports and (2) suppressing methane production by uniformly pretreating active, selective conventional FTS catalysts with submonolayer levels of sulfur.

17744 (DOE/PC/88814–T7) **Fundamental studies of retrograde reactions in direct liquefaction: Final report, September 20, 1988–November 20, 1990.** Serio, M.A.; Solomon, P.R.; Kroo, E.; Charpenay, S.; Bassilakis, R. Advanced Fuel Research, Inc., East Hartford, CT (United States). 17 Dec 1991. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88814. Order Number DE92009473. Source: OSTI; NTIS; GPO Dep.

The overall objective of the program was to improve the understanding of retrograde reactions and their dependencies on coal rank and structure, and/or coal modifications and reaction conditions. Because retrograde reactions are competitive with bond breaking reactions, an understanding of both is required to shift the competition in favor of the latter. Related objectives were to clarify the conflicting observations reported in literature on such major topics as the role of oxygen groups in retrograde reactions and to provide a bridge from very fundamental studies on pure compounds to phenomenological studies on actual coal. This information was integrated into the FG-DVC model, which was improved and extended to the liquefaction context.

17745 (DOE/PC/88891–T8) **Molecular biological enhancement of coal biodesulfurization: Final report, October 1988–December 1991.** Kilbane, J.J. II; Bielaga, B.A. Institute of Gas Technology, Chicago, IL (United States). Dec 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88891. Order Number DE92012262. Source: OSTI; NTIS; GPO Dep.

IGT Project No. 61095.

The overall objective of this project was to use molecular genetics to develop strains of bacteria with enhanced ability to remove sulfur from coal, and to obtain data that will allow the performance and economics of a coal biodesulfurization process to be predicted. (VC)

17746 (DOE/PC/88915–T13) **Steam gasification of carbon: Catalyst properties: Reporting period, September 15, 1991–December 14, 1991.** Falconer, J.L. Colorado Univ., Boulder, CO (United States). 13 Dec 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88915. Order Number DE92011621. Source: OSTI; NTIS; GPO Dep.

This research uses several techniques to measure the concentration of catalyst sites and determine their stoichiometry for the catalyzed gasification of carbon. Both alkali and alkaline earth oxides are effective catalysts for accelerating the gasification rate of coal chars, but only a fraction of the catalyst appears to be in a form that is effective for gasification, and the composition of that catalyst is not established. Transient techniques with ^{13}C labeling, are being used to study the surface processes, to measure the concentration of active sites, and to determine the specific reaction rates. We have used secondary ion mass spectrometry (SIMS) for both high surface area samples of carbon/alkali carbonate mixtures and for model carbon surfaces with deposited alkali atoms. SIMS provides a direct measure of surface composition. The combination of these results can provide knowledge of catalyst dispersion and composition, and thus indicate the way to optimally utilize carbon gasification catalysts.

17747 (DOE/PC/88930–T11) **Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, March 1, 1991–May 31, 1991.** Eisch, J.J. State Univ. of New York, Binghamton, NY (United States). 1 Jul 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88930. Order Number DE92011895. Source: OSTI; NTIS; GPO Dep.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constituents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from such sources as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons to the extensive aromatic rings in coal itself or to aromatic sulfides, amines or ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes and/or Lewis acids under moderate conditions of temperature and pressure. By learning the mechanism whereby H_2, metal hydrides or partially hydrogenated aromatics do transfer hydrogen to model aromatic compounds, with the aid of homogeneous, bimetallic catalysts, we hope to identify new methods for producing superior fuels from coal.

17748 (DOE/PC/88930–T12) **Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly summary, June 1, 1991–August 31, 1991.** Eisch, J.J. State Univ. of New York, Binghamton, NY (United States). 1 Oct 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88930. Order Number DE92011896. Source: OSTI; NTIS; GPO Dep.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constituents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from such sources as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons to the extensive aromatic rings in coal itself or to aromatic sulfides, amines or ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes and/or Lewis acids under moderate conditions of temperature and pressure. By learning the mechanism whereby H_2, metal hydrides or partially hydrogenated aromatics do transfer hydrogen to model aromatic compounds, with the aid of homogeneous, bimetallic catalysts, we hope to identify new methods for producing superior fuels from coal.

17749 (DOE/PC/88935–T10) **Inhibition of retrogressive reactions in coal/petroleum co-processing: Quarterly technical progress report, October 1, 1991–December 30, 1991.** Schobert, H.H.; Tomic, J. Pennsylvania State Univ., University Park, PA (United States). Jan 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88935. Order Number DE92011934. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a fundamental understanding of the reactions occurring at the onset of coke formation during the co-processing of coals with petroleum residua. The specific objectives include examination of chemical components, or groups of components, in coals and petroleum feedstocks to quantify and rank the effects of these components in retarding or enhancement of coke formation. The work involves bench scale reactions in microautoclaves, supplemented by studies of the carbonaceous residues by such techniques as diffuse reflectance Fourier transform infrared spectroscopy and ^{13}C nuclear magnetic resonance spectrometry. During this reporting period work focused on identification of mechanisms of coke formation. The objective of this task is to identify those compounds or components which are specifically responsible for initiating coke formation.

17750 (DOE/PC/89773–7) **Coal plasticity at high heating rates and temperatures: Seventh Technical progress report.** Gerjarusak, S.; Peters, W.A.; Howard, J.B. Massachusetts Inst. of Tech., Cambridge, MA (United States). Feb 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89773. (FE-MIT–89773-7). Order Number DE92011909. Source: OSTI; NTIS; GPO Dep.

Using a high temperature plastometer with a new cone-shaped shearing disk, the effect of shear rate (γR) on the apparent viscosity of softened coal was studied. For γR from 2.01 s^{-1} to 10.7 s^{-1}, no shear rate effect on the viscosity of Pittsburgh No. 8 high volatile bituminous coal was observed. Three other coals, each of different ranks ranging from high volatile bituminous to low volatile bituminous, were also studied. Although lower in tar and extractable yields than high volatile bituminous coals, medium and low volatile bituminous coals were found to be very plastic. Their good plastic behavior is therefore hypothesized to arise from their ability to generate higher molecular weight liquid fragments ("macrometaplast") which are not represented by tar and extractable yields.

17751 (DOE/PC/89781–9) **A novel coal feeder for production of low sulfur fuel: Quarterly technical process report, October 1, 1991–January 1, 1992.** Lin, L.; Khang, S.J.; Keener, T.C. Cincinnati Univ., OH (United States). Dept. of Chemical Engineering. [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89781. Order Number DE92012689. Source: OSTI; NTIS; GPO Dep.

In this project, a dual-screw feeder was designed for desulfurization of coal. The key parts of this reactor are two screw tubes which are used to feed coal and calcined lime particles separately, the inner tube acting as a coal pyrolyzer and the outer tube acting as a desulfurizer with hot calcined lime pellets or other renewable sorbent pellets. The objective of this project is to study the feasibility of an advanced concept of desulfurization in the coal feeder. (VC)

17752 (DOE/PC/89783–T4) **Fundamental studies of catalytic processing of synthetic liquids: Quarterly progress report, October 1, 1991–December 31, 1991.** Watson, P.R. Oregon State Univ., Corvallis, OR (United States). 22 Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89783. Order Number DE92011459. Source: OSTI; NTIS; GPO Dep.

This project revolves around understanding the fundamental processes involved in the catalytic removal of harmful oxygenated organics present in coal liquids. We are modelling the complex type of sulfided Mo catalyst proposed for these reactions with simple single crystal surfaces. These display a controlled range and number of reaction sites and can be extensively characterized by surface science techniques. We then investigate the reaction pathways for representative simple oxygenates upon these surfaces.

17753 (DOE/PC/89870–T1-Suppl.) **Comparison of slurry versus fixed-bed reactor costs for indirect liquefaction applications: A supplement to final report: Design of slurry reactor for indirect liquefaction applications.** Prakash, A.; Bendale, P.G. Viking Systems International, Pittsburgh, PA (United States). Dec 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89870. Order Number DE92011812. Source: OSTI; NTIS; GPO Dep.

This work is a comparative evaluation of slurry reactors and fixed-bed reactors, with special emphasis on cost. Relative differences between slurry reactors and fixed-bed reactors have been pointed out in previous reviews; the differences pertinent to indirect liquefaction are summarized here. Design of both types is outlined.

17754 (DOE/PC/89883–37) **Coal liquefaction process streams characterization and evaluation: Gold tube carbonization and reflectance microscopy.** Mitchell, G. (Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center); Davis, A.; Burke, F.P.; Winschel, R.A.; Brandes, S.D. Consolidation Coal Co., Library, PA (United States). Research and Development Dept.; Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center. Dec 1991. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89883. Order Number DE92009574. Source: OSTI; NTIS; GPO Dep.

This study demonstrated the use of the gold tube carbonization technique and reflectance microscopy analysis for the examination of process-derived materials from direct coal liquefaction. The carbonization technique, which was applied to coal liquefaction distillation resids, yields information on the amounts of gas plus distillate, pyridine-soluble resid, and pyridine-insoluble material formed when a coal liquid sample is heated to 450°C for one hour at 5000 psi in an inert atmosphere. The pyridine-insolubles then are examined by reflectance microscopy to determine the type, amount, and optical texture of isotropic and anisotropic carbon formed upon carbonization. Further development of these analytical methods as process development tools may be justified on the basis of these results.

17755 (DOE/PC/90005–T57) **Liquid phase methanol La-Porte process development unit: Modification operation, and support studies: Task 3.6/3.7: Alternative catalyst/life run.** Air Products and Chemicals, Inc., Allentown, PA (United States); Chem Systems, Inc., Tarrytown, NY (United States). 28 Jan 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90005. Order Number DE92012435. Source: OSTI; NTIS; GPO Dep.

In April 1987, Air Products started the third and final contract with the US Department of Energy to develop the Liquid Phase Methanol (LPMEOH) process. One of the objectives was to identify alternative commercial catalyst(s) for the process. This objective was strategically important as we want to demonstrate that the LPMEOH process is flexible and not catalyst selection limited. Among three commercially available catalysts evaluated in the lab, the catalyst with a designation of F21/0E75-43 was the most promising candidate. The initial judging criteria included not only the intrinsic catalyst activity but also the ability to be used effectively in a slurry reactor. The catalyst was then advanced for a 40-day life test in a laboratory 300 cc autoclave. The life test result also revealed superior stability when compared with that of a standard catalyst. Consequently, the new catalyst was recommended for demonstration in the Process Development Unit (PDU) at LaPorte, Texas. This report details the methodology of testing and selecting the catalyst.

17756 (DOE/PC/90056–T1) **Technology development for iron Fischer-Tropsch catalysts, September 30, 1991: Technical progress report for quarterly period ending September 30, 1991.** Davis, B.H. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. [1991]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90056. Order Number DE92013028. Source: OSTI; NTIS; GPO Dep.

Although the oxidation process of $Fe(OH)_2$ and the mechanism of formation of γ-FeOOH have been studied by several groups, many questions still need to be answered. In addition, the procedure for the synthesis of pure γ-FeOOH has not been well defined. This study is to an attempt to define better the chemistry associated with oxidizing Fe^{2+} to γ-FeOOH, and to provide a rationale for scaling this method up to produce kg/hr amounts of γ-FeOOH.

17757 (DOE/PC/90056–T2) **Technology development for iron Fischer-Tropsch catalysts: Quarterly technical progress report for period ending December 31, 1991.** Davis, B.H. Kentucky Univ., Lexington, KY (United States). Research Foundation. [1991]. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90056. Order Number DE92013029. Source: OSTI; NTIS; GPO Dep.

This report covers two aspects of the catalyst characterization studies: scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Two types of catalysts are the subject of this report: SEM studies with as-received, pretreated and used samples of a Ruhrchemie type catalyst and TEM examination of four crystal structures of FeOOH and Fe_3O_4.

17758 (DOE/PC/90293–T3) **High temperature membranes for H_2S and SO_2 separations: Quarterly progress report, October 1, 1991–December 31, 1991.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1991]. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90293. Order Number DE92010451. Source: OSTI; NTIS; GPO Dep.

High temperature membrane separation techniques have been applied to gas mixtures involved in coal utilization. For coal gasification, H_2S has been removed from the syn-gas stream, split into hydrogen, which enriches the syn-gas, and sulfur, which can be condensed from an inert gas sweep stream. For coal combustion, SO_2 has been separated from the flue gas, with concentrated SO_3 produced as a by-product. Both processes appear economically viable but each requires fundamental improvements: both the H_2S cell and the SO_2 cell require more efficient membranes and the H_2S cell needs a more efficient anode. Membranes will be fabricated by either hot-pressing, impregnation of sintered bodies or tape casting. Research conducted during the present quarter is highlighted, with an emphasis on progress towards these goals.

17759 (DOE/PC/90294–T1) **Biotic and abiotic carbon to sulfur bond cleavage: Technical report, July 1, 1991–September 30, 1991.** Frost, J.W. Purdue Univ., Lafayette, IN (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90294. Order Number DE92012640. Source: OSTI; NTIS; GPO Dep.

Cleavage of aliphatic organosulfonate carbon to sulfur (C-S) bonds, a critical link in the global biogeochemical sulfur cycle, has been identified in Escherichia coli K-12. Enormous quantities of inorganic sulfate are continuously converted (Scheme I) into methanesulfonic acid 1 and acylated 3-(6-sulfo-α-D-quinovopyranosyl)-L-glycerol 2. Biocatalytic desulfurization (Scheme I) of 1 and 2, which share the structural feature of an aliphatic carbon bonded to a sulfonic acid sulfur, completes the cycle, Discovery of this desulfurization in E. coli provides an invaluable paradigm for study of a biotic process which, via the biogeochemical cycle, significantly influences the atmospheric concentration of sulfur-containing molecules.

17760 (DOE/PC/90296–T5) **Structure and thermochemical kinetic studies of coal pyrolysis: Quarterly technical progress report, October 1–December 31, 1991.** Dodoo, J.N.D. Maryland Univ., Princess Anne, MD (United States). Dept. of Natural Sciences. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90296. Order Number DE92012552. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this project is an intensive effort on the application of laser to the microscopic structure and thermochemical kinetic studies of coal particles pyrolysis, char combustion and ash transformation at combustion level heat fluxes in a laser beam. Research emphasis in FY91 is placed on setup and calibration of the laser pyrolysis system, preparation and mass loss studies of Beulah lignite and subbituminous coals. The task is therefore divided into three subtasks.

17761 (DOE/PC/90298–T6) **Catalysis and co-catalysis of bond cleavages in coal and coal analogs: Quarterly report, November 1, 1991–January 31, 1992.** Miller, B. Massachusetts Univ., Amherst, MA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90298. Order Number DE92012646. Source: OSTI; NTIS; GPO Dep.

Catalytic hydrogenolysis and thermal fragmentation of coal-related compounds are covered in this report. Data are tabulated for the following processes: (1) Transfer Hydrogenolysis in Tetralin at 450°C in Stainless Steel Reactors; (2) Effects of Diphenylamine on Fragmentation of 1,1-Dibenzyl-1,4-dihydronaphthalene at 150°C; (3) Effect of Diphenylamine on Rate of Fragmentation of 1,1-Di-p-tolyl-1,4-dihydronaphthalene at 150°C; (4) Fragmentation of 1,1-Di-(4-chlorobenzyl)-1,4-dihydronaphthalene at 150°C. (VC)

17762 (DOE/PC/90300–T5) **Rapid pressure swing absorption cleanup of post-shift reactor synthesis gas: Technical progress report, October 1, 1991–December 31, 1991.** Sirkar, K.K.; Majumdar, S.; Bhaumik, S. Stevens Inst. of Tech., Hoboken, NJ (United States). Center for Membranes and Separation Technologies. 31 Jan 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90300. Order Number DE92011627. Source: OSTI; NTIS; GPO Dep.

In order to increase the production rate of purified gas stream, a new hollow fiber module has been fabricated with more number of hollow fibers. A few experiments have also been carried out using a CO_2-N_2 feed gas mixture and water as an absorbent in the new module. With the new module, it was possible to increase the production rate of purified gas by a significant amount while the cycle time for vacuum desorption was considerably reduced. Preparations are now being made to study the absorption behavior of CO_2-N_2 gas mixture with a reactive absorbent liquid such as aqueous diethanolamine solution.

17763 (DOE/PC/90305–T5) **Probe molecule studies: Active species in alcohol synthesis: Fifth quarterly report, October 1991–December 1991.** Blackmond, D.G. Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering. Dec 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90305. Order Number DE92011626. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop a better understanding of the mechanism of alcohol synthesis from CO/H_2 by adding probe molecules (principlely, CH_3NO_2) to the dynamic reaction mixture and following how the added probe molecule is incorporated into the products to distinguish the dominant pathways from the possibilities proposed in the literature. Cu/ZnO/Al_2O_3 and Co/Cu/ZnO/Al_2O_3 catalyst systems have been chosen for this study. It is well known that Cu/ZnO methanol synthesis catalysts can be made into higher alcohol synthesis catalysts by adding alkali metal (Cs, K, Na). The inclusion off Group VIII metals (Co, Fe) for the same purpose has been studied to a much lesser extent. Few mechanistic studies of the Co/Cu/ZnO/Al_2O_3 have been reported in the literature. Study of a catalyst system consisting of both Group VIII metal and well-known methanol synthesis catalysts may bridge the knowledge of supported metals and traditional alcohol synthesis catalysts.

17764 (DOE/PC/90307–5) **Reactivity of young chars via energetic distribution measurements: Quarterly technical progress report, 15 September 1991–15 December 1991.** Calo, J.M.; Zhang, L.H.; Lilly, W.D. Brown Univ., Providence, RI (United States). Div. of Engineering. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90307. Order Number DE92011910. Source: OSTI; NTIS; GPO Dep.

The temperature programmed desorption (TPD) has become a standard technique for investigating the physico-chemical state of adsorbed species on surfaces. In this reporting period, a new TPD-MS/TGA (mass spectrometry/thermal gravimetric analysis) system has been designed, and all the necessary components have been acquired. This new system is built around a new Cahn D-200 digital recording microbalance, which was recently purchased for this purpose. The TPD reactor essentially becomes the "hangdown" tube for this microbalance. The control and data logging of this new experimental system will be performed using a Macintosh II microcomputer with a GW Instruments 625 Jr. interface. A new "hangdown" tube is being constructed, as well as a new furnace to accommodate it.

17765 (DOE/PC/90313–T3) **Advanced soluble hydroliquefaction and hydrotreating catalysts: Quarterly report No. 5, August 7, 1991–November 6, 1991.** Laine, R.M. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Materials Science and Engineering); Stoebe, T. Washington Univ., Seattle, WA (United States). Dept. of Materials Science and Engineering. 22 Nov 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90313. Order Number DE92011897. Source: OSTI; NTIS; GPO Dep.

The purpose of the present program is to develop soluble analogs of surface confined catalysts that can be impregnated directly into the coal structure at low temperatures. This approach should avoid problems related to surface area dependence, a two phase (surface-liquid) reaction system and, mass transport limitations.

17766 (DOE/PC/90313–T4) **Advanced soluble hydroliquefaction and hydrotreating catalysts: Quarterly report No. 6, November 7, 1991–December 31, 1991.** Laine, R.M. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Materials Science and Engineering); Stoebe, T. Washington Univ., Seattle, WA (United States). Dept. of Materials Science and Engineering. 31 Jan 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90313. Order Number DE92011898. Source: OSTI; NTIS; GPO Dep.

The purpose of the present program is to develop soluble analogs of surface confined catalysts that can be impregnated directly into the coal structure at low temperatures. This approach should avoid problems related to surface area dependence, a two phase (surface- liquid) reaction system and, mass transport limitations.

17767 (DOE/PC/90313–T5) **Advanced, soluble hydroliquefaction and hydrotreating catalysts: Annual report No. 1, August 7, 1990–August 6, 1991.** Laine, R.M (Michigan Univ., Ann Arbor, MI (United States). Dept. of Materials Science and Engineering); Stoebe, T. Washington Univ., Seattle, WA (United States). Dept. of Materials Science and Engineering. 9 Sep 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90313. Order Number DE92012558. Source: OSTI; NTIS; GPO Dep.

The purpose of the present program is to develop soluble analogs of surface confined catalysts that can be impregnated directly into the coal structure at low temperatures. This approach should avoid problems related to surface area dependence, a two phase (surface-liquid) reaction system and, mass transport limitations. Heteropolyanions (HPAs) offer the opportunity to develop soluble forms of surface confined catalysts. HPAs are multi-functional catalysts that could be used to promote both hydroliquefaction and hydrotreating. In theory, these functions could be employed sequentially or simultaneously and could permit exceptional control of liquefaction reactions and reaction conditions. Thus, the current research program involves efforts to evaluate HPAs as soluble liquefaction nd hydrotreating catalysts, with the goal of developing soluble analogs of surface confined catalysts.

17768 (DOE/PC/91288–T1) **High temperature electrochemical separation of H_2S from coal gasification process streams: Quarterly progress report, October 1, 1991–December 31, 1991.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91288. Order Number DE92012505. Source: OSTI; NTIS; GPO Dep.

An advanced process for the separation of hydrogen sulfide from coal gasification product streams through an electrochemical membrane is being developed using the funds from this grant. H_2S is removed from the syn-gas stream, split into hydrogen, which enriches the syn-gas, and sulfur, which can be condensed from an inert gas sweep stream. The process allows removal of H_2S without cooling the gas stream and with neglible pressure loss through the separator. The process is economically attractive by the lack of adsorbents and the lack of a Claus process for sulfur recovery.

17769 (DOE/PC/91291–T1) **[Mechanism of hydrogen incorporation in coal liquefaction]: Second progress report as of January 31, 1991.** Kentucky Univ., Lexington, KY (United States). Research Foundation. [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91291. Order Number DE92011303. Source: OSTI; NTIS; GPO Dep.

In this reporting period, data are tabulated and interpreted for three yield distributions: (1) Product Distribution in the Thermolysis of Diphenylethane at 450°C for 30 Minutes; (2) Deuterium Distribution in Products from Thermolysis of Diphenylethane at 450°C Under D_2; (3) Aliphatic vs. Aromatic Deuterium in Products from Thermolysis of 1,2-Diphenylethane under D_2 at 450°C for 30 min.

17770 (DOE/PC–92011473) **PETC Review, Issue 3, March 1991.** Blaustein, B.; Reiss, J.; Robotti, S.; Brown, J.; Carter, C.; Evans, E.; Hammer, D. (eds.). USDOE Pittsburgh Energy Technology Center, PA (United States). Mar 1991. 49p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011473. Source: OSTI; NTIS; GPO Dep.

This issue of PETC Review presents brief discussion of the status of two DOE research program: (1)Coal Liquefaction and (2)Low-Cost Retrofit Technologies for Reducing SO_2, NO_x, and Particulates as part of the Clean Coal Technology Program. Air Toxics and the 1990 Clean Air Act are also discussed with respect to Environmental Protection Agency regulations. Supplemental sections on events, special focuses, publication listing, etc. are also included.

17771 (SAND–91-2695C) **Dependence of fixed-bed reaction processes on bed void distribution.** Hobbs, M.L. (Sandia National Labs., Albuquerque, NM (United States)); Radulovic, P.T.; Smooot, D.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC21-86MC23075. (CONF-920707–16: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006678. Source: OSTI; NTIS; GPO Dep.

Variations of bed void fraction in a full-scale, reacting, fixed-bed coal gasifier have been deduced from measured axial pressure profiles obtained during gasification of seven coal types ranging from lignite to bituminous. Packed-bed pressure correlations were used to calculate the void fractions based on monotonic polynomial fits of measured pressure profiles. Insights into the fixed-bed combustion processes affected by the void distribution were obtained by a one-dimensional, steady-state, fixed-bed combustion model. Predicted temperature profiles from this model compare reasonably well to experimental data. The bed void distributions are not linear but are perturbed by vigorous reactions in the devolatilization and oxidation zones. Results indicate that a dramatic increase in temperature and associated gas release causes the bed to expand and the gas void space to increase. Increased void space localized in the combustion zone causes the steep temperature gradient to decrease and the location of the maximum temperature to shift. Also, large feed gas flow rates cause the void fraction in the ash zone to increase.

17772 (SAND–91-8719) **Predicting the transient devolatilization of various coals with FLASHCHAIN.** Niksa, S. (Stanford Univ., CA (United States). High Temperature Gasdynamics Lab.); Kerstein, A.R. Sandia National Labs., Livermore, CA (United States). Nov 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–7: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006680. Source: OSTI; NTIS; GPO Dep.

Predicting the ultimate weight loss and tar yields from any coal type is treated here as a matter of distinguishing aliphatic, heteroatomic, and aromatic constituents. This crucial partitioning is implemented with balances based on the ultimate analysis, carbon aromaticity, aromatic carbon number per monomeric unit, and other characterization data. However, predicted ultimate weight loss and tar yields reported here for coals across the rank spectrum demonstrate that the ultimate analysis is the only coal-specific input needed to capture coal rank dependences with this theory. Regression values of of all other inputs are adequate. This study also develops basis for accurate predictions of the transient devolatilization of any coal type. The tendencies for slower reaction rates and a narrower temperature range for devolatilization with increasing rank is incorporated via correlations with carbon content of the frequency factor and standard deviation about the mean energy for bridge decomposition. This approach is evaluated against ultimate weight loss and tar yields for 14 samples of ranks from lignite through anthracite, for heating rates of 725 K/s and 15,000 K/s. Comparisons to measured ultimate yields for temperatures from 450 to 1200 K as well as weight loss transients at 800 K/s for several diverse coals support the theory's representation of product evolution rates, and its rank and temperature dependences.

17773 (UCRL-JC–109210) **The synthesis and characterization of new copper coordination complexes containing an asymmetric coordinating chelate ligand: Application to enzyme active site modeling.** Droege, M.W. (Lawrence Livermore National Lab., CA (United States)); Satcher, J.H. Jr.; Reibold, R.A.; Weakely, T.J.R. Lawrence Livermore National Lab., CA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920444–21: American Chemical Society national meeting, San Francisco, CA (United States), 5-10 Apr 1992). Order Number DE92011532. Source: OSTI; NTIS; GPO Dep.

A new class of ligand which produces a binuclear metal complex with coordination asymmetry has been designed and synthesized. A binuclear copper complex has been prepared and characterized including a single crystal x-ray structure analysis. The structure reveals that one copper is 5-coordinate (distorted square pyramidal) while the other copper is only 4-coordinate (distorted square planar) and are separated by an endogenous μ-alkoxo oxygen and a bridging acetate. Although this structural type of chelator has been found in biological systems, it has not been previously described for inorganic coordination complexes prepared by design. It is anticipated that this ligand and derivatives of it will play an important role in mimicking chemical reactivity of enzyme active sites that function by substrate interaction at only one metal of a multimetal active site.

17774 (VTT-TIED–1263) **Desulphurization of hot product gas by iron compounds and mixed metal-oxide sorbents: Literature review.** Hepola, J. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Fuel and Process Technology); Kurkela, E.; Maekinen, T. Technical Research Centre of Finland, Espoo (Finland). Jul 1991. 64p. (In Finnish). Order Number DE92506493. Source: OSTI; NTIS (US Sales Only).

According to thermodynamic equilibrium studies, it is possible to reduce the sulphur content of dry product gas by iron compounds to < 100 ppm at temperatures lower than 450 deg C. The equilibrium content of hydrogen sulphide is increased by iron oxides, while the temperature and the water vapour content of the gas increase. The equilibrium content of hydrogen sulphide is not essentially affected by pressure. In a typical gas atmosphes of peat fluid-bed gasification the iron oxide is not reducible into elemental iron. Iron oxide is, without compound agents, insufficiently durable in several successive absorption and regeneration cycles at high temperatures and pressures. By mixing the iron compound, for example, with aluminium oxide or silicon dioxide or by adding small amounts of certain additives the durability of the sorbent can be improved significantly. Soroents superior to iron oxide are also studied. The im of the development work of mixed metal sorbents is to improve the sorbent so that it stains a sufficient strength and desulphurization capacity in recurrent absorption and regeneration cycles. Mixed metal oxide compounds with a higher desulphurization capacity and an ability to function at higher temperatures than zinc ferrite, are being studied. One aim is to simultaneously remove also other detrimental compounds, such as ammonia and chlorides, from the gas. Different process alternatives for sulphur recovery are being studied. Simpler and cheaper processes for replacing the conventional Claus process in the production of elemental sulphur are being developed.

0106 Properties and Composition

Refer also to citation(s) 17713, 17714, 17720, 17721, 17750, 17759, 17761, 17764, 17772, 17784, 17786, 17787, 17815, 17821, 17823, 18831, 18992

17775 (DOE/PC/91305–1) **Characterization of porosity via secondary reactions: Quarterly technical progress report, 15 September 1991–15 December 1991.** Calo, J.M.; Lilly, W.D. Brown Univ., Providence, RI (United States). Div. of Engineering. [1991]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91305. Order Number DE92013026. Source: OSTI; NTIS; GPO Dep.

During the course of recent work applying temperature programmed desorption (TPD) to the determination of energetic distributions of oxygen complexes on the surfaces of oxidized coal chars, we discovered that secondary interactions occurring within the char structure during TPD produce characteristic features in the resultant spectra that appear to be quite sensitive to char porosity. The relative and absolute extents of these secondary interactions from the basis of a potential characterization technique. The use of such a method to characterize coal char porosity is potentially attractive because the requisite spectra can be obtained in a single TPD experiment – a very facile experimental procedure. However, the unambiguous and quantitative interpretation of such data in terms of parameters that can be used to characterize coal char porosity still requires development and an improved understanding of the controlling phenomena. These issues define the primary focus of the current proposal.

17776 (NUTEK-KOL–92-1) **Very low temperature ashing (VLTA). A method of extracting mineral matter from coal (An improvement of the LTA method).** Shirazi, A.R. (Chalmers Univ. of Tech. and Goeteborg Univ. (Sweden). Dept. of Inorganic Chemistry); Lindqvist, O. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1991. 30p. Project NUTEK-226-018. Order Number DE92506601. Source: OSTI; NTIS (US Sales Only).

To extract and study mineral matter in coal is a major field in coal science. In this study, Low Temperature Ashing (LTA) has been used to extract sulphide minerals from coal. In LTA, most, but not all of, the minerals in coal are unaffected. The disadvantage of this method has been that the actual temperature inside the oxidation chambers could not be measured and ,consequently, the ashing process could not be controlled. For example, in the case of this study, the sulphide minerals usually oxidize and some become lost as SO_2 in the ashing process. When the ashing temperature can be measured and controlled, the ashing process inside the chambers can be controlled. This makes it possible to have the same ashing condition for different coal samples of different ranks and calorific values, so that minerals in coal can be studied without any changes or damage of the minerals in the samples. The temperature inside the chambers was measured with thermographs, which changes colour from silver-white to black when they reach a certain temperature. To control the temperature, the oxygen was diluted with helium gas before entering the LTA. The gases given off, here called the 'off-gas', from the LTA were analyzed with a quadrupole mass spectrometer under different experimental conditions. The ashing process was also studied in different atmospheres. In this study the experiments showed that the desirable oxygen/helium ratio is directly proportional to the rank and sulphur content of the coal sample. 17 refs., 32 figs.

17777 (VTT-OPT–35) **On the measurement on weather and evaporation at a peat production site.** Heikinheimo, M. (Finnish Meteorological Inst., Helsinki (Finland)); Koskela, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Oct 1991. 42p. (In Finnish). Order Number DE92506477. Source: OSTI; NTIS (US Sales Only).

OPTIMITURVE Research Programme.

A real time measuring system for the relevant components of micro climate of a peat production site is described. The system is applicable, during the production season, for the continuous monitoring of standard weather and heat flux components over milled peat. Potential and actual evaporation is calculated from the measured data. Actual evaporation was obtained with the aerodynamic method using the information of measured surface temperature. The method gave consistent results with the Bowen- ratio method which was used as the microclimatological reference. Due to practical reasons the net-radiationmeter had to be placed over an uncultivated peat. This resulted in an overall underestimation of the evaporation, particularly on the occasions of turning of the milled peat layer. The bias in evaporation can be improved by calculating the net-radiation from measured surface temperature and global radiation data. The evaporation patterns corresponding to harvest runs and occasions of turning of the milled peat layer are discussed.

0108 Waste Management

Refer also to citation(s) 17731, 17758, 17770, 17815, 17818, 17820, 17821, 18128, 18656, 18748, 19426

17778 (ANL/CP–75635) **Emerging NO_x/SO_x control technologies.** Livengood, C.D. (Argonne National Lab., IL (United States)); Markussen, J.M. Argonne National Lab., IL (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920294–1: NO_x control V conference, Long Beach, CA (United States), 9-11 Feb 1992). Order Number DE92010279. Source: OSTI; NTIS; GPO Dep.

The development of advanced flue-gas-cleanup (FGC) technologies fro the control of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions continues to be a very active area of research and development, both in this country and abroad. This activity is driven both by legislation (such as the recent revisions to the Clean Air Act) and by the desire to develop technologies that surpass current options in terms of performance, costs, operability, and waste/by-product properties. New issues, such as concern over global climate changes and the health effects of toxic air emissions ("air toxics"), are also helping to shape and prioritize the development programs. This paper provides a status report on a number of integrated FGC systems that have reached a significant stage of development, focusing on post-combustion processes that have been rested or are ready for testing at the pilot scale or larger. While some information that was presented at the 1991 CIBO NO_x IV Control Conference is repeated for the sake of completeness, we have updated each section to reflect the most recent reported developments. Although a wide variety of technologies is discussed, it should be noted that there are a number of other integrated approaches, such as slagging combustors, fluidized-bed combustion, gasification/combined-cycle systems, and various processes combining low-NO_x burners with SO_2-sorbent injection in the furnace. These other approaches also offer features that should not be overlooked when evaluating alternatives for a specific application.

17779 (BNL–47167) **The Clean Air Act Amendments of 1990: Hazardous Air Pollutant Requirements and the DOE Clean Coal Technology Program.** Moskowitz, P.D. (Brookhaven National Lab., Upton, NY (United States)); DePhillips, M.; Fthenakis, V.M.; Hemenway, A. Brookhaven National Lab., Upton, NY (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-911139–2: Managing hazardous air pollutants: state of the art, Washington, DC (United States), 4-6 Nov 1991). Order Number DE92012210. Source: OSTI; NTIS; GPO Dep.

The purpose of the US Department of Energy – Office of Fossil Energy (DOE FE) Clean Coal Technology Program (CCTP) is to provide the US energy marketplace with advanced, efficient, and environmentally sound coal-based technologies. The design, construction, and operation of Clean Coal Technology Demonstration Projects (CCTDP) will generate data needed to make informed, confident decisions on the commercial readiness of these technologies. These data also will provide information needed to ensure a proactive response by DOE and its industrial partners to the establishment of new regulations or a reactive response to existing regulations promulgated by the US Environmental Protection Agency (EPA). The objectives of this paper are to: (1) Present a preliminary examination of the potential implications of the Clean Air Act Amendments (CAAA) – Title 3 Hazardous Air Pollutant requirements to the commercialization of CCTDP; and (2) help define options available to DOE and its industrial partners to respond to this newly enacted Legislation.

17780 (CONF-900391–7) **Integrated testing of the NO_xSO process (Simultaneous removal of SO_2 and NO_x).** Yeh, J.T. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Pennline, H.W.; Joubert, J.I.; Ma, W.T.; Haslbeck, J.L.; Gromicko, F.N. USDOE Pittsburgh Energy Technology Center, PA (United States). [1990]. 29p. Sponsored by USDOE, Washington, DC (United States). From 1990 American Institute of Chemical Engineers (AIChE) spring health and safety symposium; Orlando, FL (United States); 18-22 Mar 1990. Order Number DE92011911. Source: OSTI; NTIS; GPO Dep.

Parametric studies with the NOXSO process – a dry, regenerable flue gas treatment system that simultaneously removes SO_2 and NO_x from flue gas produced by the combustion of coal – were conducted. The reusable sorbent that was tested consisted of sodium carbonate impregnated on a high surface area γ-alumina sphere (1.6-mm nominal diameter). All process steps, including adsorption and regeneration, were integrated into a new 60-KW_e-scale Life-Cycle Test Unit so that continuous, long-term operation of the total process could be experimentally evaluated. The effects of sorbent flow rate, temperature, inlet SO_2 and NO_x concentrations, and sorbent residence time (fluid bed depth) on pollutant removal efficiencies in the absorption step were determined. Also, the impact of the type of regenerant gas, temperature, steam, excess regenerant gas, and diluent on the regeneration of the sorbent was investigated. Sorbent properties with respect to time on stream (cycles of operation) are also reported.

17781 (CONF-9107134–4) **Experimental model for absorption of nitrogen oxides by ferrous EDTA solution in the presence of SO_2 and sulfites.** Walker, R.J. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). From 7. annual coal preparation, utilization, and environmental control contractors conference; Pittsburgh, PA (United States); 15-18 Jul 1991. Order Number DE92011744. Source: OSTI; NTIS; GPO Dep.

Experimental results and an analysis are given for absorption of nitric oxide in buffered ferrous EDTA aqueous solution. The analysis uses the film model for parallel irreversible absorption of two gases (NO and O_2) by a solute (ferrous EDTA) at a finite rate in countercurrent packed column. Oxidation of ferrous EDTA to ferric EDTA by O_2, NO, and NO_2 was investigated experimentally in the presence of SO_2, sulfite, and bisulfite. Oxidation by O_2 and NO were both important for typical flue gas compositions.

17782 (CONF-9110129–2) **Scaleup tests of duct injection technology.** Hunt, J.E. (Gilbert/Commonwealth, Inc., Reading, PA (United States)); Kim, Soung, S.; Gooch, J.P. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 23p. Sponsored by USDOE, Washington, DC (United States). From 8. Korea-U.S. joint workshop on coal utilization technology; Seoul (Korea, Republic of); 28 Oct - 1 nov 1991. Order Number DE92011742. Source: OSTI; NTIS; GPO Dep.

The duct injection test facility located at Beverly, Ohio has been fully operational since June 1990. The facility is a 12-MWe, 50000-acfm "slipstream" system of flue gas generated from a dry-bottom pulverized coal-fired boiler, rated at 585 MWe. The duct injection tests are conducted to gain a thorough understanding of the scaleup and design requirements and operational limitations of duct injection technology. The technologies being tested include slurry sorbent injection of hydrated lime using dual fluid nozzles and pneumatic injection of dry hydrated lime with flue gas humidification. With the slurry injection, 45 to 75 percent of SO_2 removal was observed at a calcium-to-sulfur ratio ranging from 1.0 to 2.5. The sorbent utilization varied from 25 to 45 percent. After humidification, the gas temperature in the duct was 20°F to 30°F above the saturation point. This test program is part of a larger DOE program to fully characterize low-cost, retrofittable dry SO_2 removal technologies for application to existing power plants.

17783 (CONF-911226–2) **Results from LIMB extension testing at the Ohio Edison Edgewater Station.** Goots, T.R. (Babcock and Wilcox Co., Barberton, OH (United States)); DePero, M.J.; Purdon, T.H.; Nolan, P.S.; Hoffmann, J.L.; Arrigoni, T.W. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). From SO_2 control symposium; Washington, DC (United States); 3-6 Dec 1991. Order Number DE92011743. Source: OSTI; NTIS; GPO Dep.

The primary purpose of the DOE extension testing, which began in April 1990, was to demonstrate the generic applicability of Limestone Injection Multistage Burner (LIMB) technology. The program sought to characterize the SO_2 emissions that result when various calcium-based sorbents are injected into the furnace, while burning coals with a range of sulfur content from 1.6 to 3.8 percent. The four sorbents used included calcitic limestone, dolomitic hydrated lime, calcitic hydrated lime, and calcitic hydrated lime with a small amount of added calcium lignosulfonate. The initial EPA program focused on tests with the calcitic hydrated lime while burning a 3.0 percent sulfur Ohio coal. Tests with the lignosulfonate-doped material were added after pilot tests appeared to show enhanced reactivity. The results presented for the various coal/sorbent combinations include further characterization of the SO_2 removal to be expected with and without humidification to a close approach to saturation, the effects of limestone particle size distribution, and the effects of injection at different elevations in the furnace. NO_x emissions are also presented since the bioler operated with low-NO_x burners throughout all the tests. The burners were installed as part of the original LIMB demonstration.

17784 (DOE/MC/11076–3073) **Methods for the speciation and determination of arsenic and selenium in coal combustion products.** Schabron, J.F.; Hart, B.K.; Niss, N.D.; Brown, T.H. Western Research Inst., Laramie, WY (United States). Nov 1991. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE92001258. Source: OSTI; NTIS; GPO Dep.

Methods of sample preparation for the determination of total selenium, and selenite, selenate, arsenite, and arsenate in coal fly ash materials were evaluated. The measurement methods use atomic spectroscopy for the determination of total concentrations and ion chromatography (IC) for the determination of individual ionic species. Sample preparation procedures which minimize the loss or alteration of the species of interest was explored and defined. The utility of the sample preparation methods can be sample dependent, so caution is advised in their use. IC conditions were established for the determination in extract solutions of selenite, selenate, arsenite, and arsenate with minimal interference from common anions.

17785 (DOE/PC/79796–T18) **Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 6, October 1–December 31, 1991.** Energy and Environmental Research Corp., Irvine, CA (United States). 7 Feb 1992. 52p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract FC22-87PC79796. Order Number DE92011623. Source: OSTI; NTIS; GPO Dep.

Clean Coal Technology implies the use of coal in an environmentally acceptable manner. Coal combustion results in the emission of two types of acid rain precursors: oxides of sulfur (SO_x) and oxides of nitrogen (NO_x). This Clean Coal Technology project will demonstrate a combination of two developed technologies to reduce both NO_x and SO_x emissions: gas reburning and calcium based dry sorbent injection. The demonstrations will be conducted on two pre-NSPS utility boilers representative of the US boilers which contribute significantly to the inventory of acid rain precursor emissions: tangentially and cyclone fired units. Because of cost growth and lack of available funding, no further work has been done after Phase 1 at site B; the wall fired unit.

17786 (DOE/PC/79903–T11) **Optical properties of flyash: Quarterly report, 1 October–31 December 1991.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Jan 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE92011899. Source: OSTI; NTIS; GPO Dep.

The general aims of this research are to provide a fundamental scientific basis for the physical understanding and reliable calculation of radiative heat transfer in coal combustion systems, particularly as its influenced by the presence of inorganic constituents deriving from the mineral matter in coal.

17787 (DOE/PC/79903–T12) **Size distributions of fly ash using Coulter Multisizer: Use of multiple orifices and fitting to truncated log-normal distributions.** Ghosal, S.; Ebert, J.L.; Self, S.A. Stanford Univ., CA (United States). Nov 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE92012263. Source: OSTI; NTIS; GPO Dep.

Fly ash particles, which are predominantly spherical and glassy, are produced by melting of the mineral inclusions in the coal during combustion. Particle diameters can range from sub-micrometer (micron or μm) to greater than 100 μm. The size distribution of fly ash is needed to determine its role in the radiation transfer process in pulverized coal combustors. The Coulter Multisizer is an useful instrument for sizing powders with a broad size distribution. A single Multisizer orifice can size particles only within a specific size range limited at the lower end to a few percent of orifice diameter by sensitivity and at the upper end by increasing non-linearity of the signal-volume relation. A scheme for combining data obtained using orifices of different diameters is described. The manufacturers state that the smallest particle which can be sized accurately is nominally 2% of the diameter of the orifice. However, it was found that the data for particles less than 4% of the orifice diameter were not reliable. In order to use the smaller orifices, the larger particles have to be removed from the sample. A wet-sieving apparatus, designed for accurate separation of the particles by size, is described. A log-normal distribution function, truncated outside the measurement limits, fits the size distribution data well. Size parameters for fly ashes of six representative US coals are presented.

17788 (DOE/PC/79921–T11) **Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Final report, September 1987–January 1991.** Sotirchos, S.V. Rochester Univ., NY (United States). Dept. of Chemical Engineering. May 1991. 124p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-87PC79921. Order Number DE92009916. Source: OSTI; NTIS; GPO Dep.

The primary objective of the project was the investigation of the pore strucure and reactivity changes occurring in metal/metal oxide sorbents used for desulfurization of hot coal gas during sulfidation and regeneration, with particular emphasis placed on the effects of these changes on the sorptive capacity and efficiency of the sorbents. Commercially available zinc oxide sorbents were used as model solids in our experimental investigation of the sulfidation and regeneration processes.

17789 (DOE/PC/88851–T1) **Scaleup tests and supporting research for the development of duct injection technology: Topical report No. 1, Literature review.** Gooch, J.P. (Southern Research Inst., Birmingham, AL (United States)); Dismukes, E.B.; Dahlin, R.S.; Faulkner, M.G.; Klett, M.G.; Buchanan, T.L.; Hunt, J.E. Southern Research Inst., Birmingham, AL (United States); Gilbert/Commonwealth, Inc., Reading, PA (United States); American Electric Power Service Corp., Columbus, OH (United States). May 1989. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88851. (G/C–2787-1). Order Number DE92010988. Source: OSTI; NTIS; GPO Dep.

Gilbert Commonwealth, Southern Research Institute and the American Electric Power Service Corporation have embarked on a program to convert DOE's Duct Injection Test Facility located at the Muskingum River Power Plant of Ohio Power Company to test alternate duct injection technologies. The technologies to be tested include slurry sorbent injection of hydrated lime using dual fluid nozzles, or a rotary atomizer and pneumatic injection of hydrated lime, with flue gas humidification before or after sorbent injection. The literature review and analysis contained in this report is a part of the preparatory effort for the test program.

17790 (DOE/PC/88852–T5) **Duct injection technology prototype development: Scale-up methodology and engineering design criteria: Topical report No. 4.** United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Apr 1991. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88852. Order Number DE92009616. Source: OSTI; NTIS; GPO Dep.

The objective of the Duct Injection Technology Prototype Development project is to develop a sound design basis for applying duct injection technology as a post-combustion SO_2 emissions control method to existing, pre-NSPS, coal-fired power plants. This report is divided into five major topics: (1) design criteria; (2) engineering drawings; (3) equipment sizing and design; (4) plant and equipment arrangement considerations; and (5) equipment bid specification guidelines.

17791 (DOE/PC/89807–T7) **An evaluation of a pre-charging pulse-jet filter for small combustor particulate control: Project quarterly report, December 1, 1989–February 28, 1990.** Quimby, J.M. Research-Cottrell, Inc., Somerville, NJ (United States). Environmental Services and Technologies Div. Apr 1990. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89807. Order Number DE92012660. Source: OSTI; NTIS; GPO Dep.

The objective of this test program is the performance and economic evaluation of a pre charged-pulse jet filter as the principal particulate control device for a commercial or industrial scale coal fired combustor. Performance factors that will be considered are the effects of particle charge, air/cloth ratio, fabric types, percent humidity and inlet particulate loading on fine particle collection efficiency, and pressure drop. Economic factors that will be considered are capital costs, energy and other operating costs, and maintenance costs. The program will result in a recommendation regarding the relative suitability of the pre charged pulse-jet filter for small combustor particulate control, as compared to other control devices. Fine particle control capability, ease of operation, and overall economics will be taken into consideration in making comparisons.

17792 (DOE/PC/90292–T4) **Alternative formulations of regenerable flue gas cleanup catalysts: Progress report, September 1, 1990–August 31, 1991.** Mitchell, M.B.; White, M.G. Clark Atlanta Univ., GA (United States). [1991]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90292. Order Number DE92011622. Source: OSTI; NTIS; GPO Dep.

The major source of man-made SO_2 in the atmosphere is the burning of coal for electric power generation. Coal-fired utility plants are also large sources of NO_x pollution. Regenerable flue gas desulfurization/NO_x abatement catalysts provide one mechanism of simultaneously removing SO_2 and NO_x species from flue gases released into the atmosphere. The purpose of this project is to examine routes of optimizing the adsorption efficiency, the adsorption capacity, and the ease of regeneration of regenerable flue gas cleanup catalysts. We are investigating two different mechanisms for accomplishing this goal. The first involves the use of different alkali and alkaline earth metals as promoters for the alumina sorbents to increase the surface basicity of the sorbent and thus adjust the number and distribution of adsorption sites. The second involves investigation of non-aqueous impregnation, as opposed to aqueous impregnation, as a method to obtain an evenly dispersed monolayer of the promoter on the surface.

17793 (DOE/PC/90361-T5) **Catalytic fabric filtration for simultaneous NO_x and particulate control: Quarterly technical progress report, October 1, 1991–December 31, 1991.** Weber, G.F.; Ness, S.R.; Laudal, D.L.; Dunham, G. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. Feb 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90361. Order Number DE92012639. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is the development of a catalytic fabric filter for simultaneous NO_x and particulate control. The catalytic fabric filter must provide high removal efficiency of NO_x and particulate matter. An acceptable bag and catalyst life must be demonstrated, and process economics must show a significant cost savings when compared to a commercial SCR process and conventional particulate control. Specific goals include the following: (1) Reduce NO_x emissions to 60 ppm or less. (2) Demonstrate particulate removal efficiency of >99.5%. (3) Demonstrate a bag/catalyst life of >1 year. (4) Control ammonia slip to >25 ppm. (5) Show that catalytic fabric filtration can achieve a 50% cost savings over conventional fabric filtration and SCR control technology. (6) Determine compatibility with SO_2 removal systems. (7) Show that the concept results in a nonhazardous waste product.

17794 (DOE/PC/90363-T3) **Development of advanced NO_x control concepts for coal-fired utility boilers: Quarterly technical progress report No. 1, September 26–December 31, 1990.** Newhall, J.; England, G.; Seeker, W.R. Energy and Environmental Research Corp., Irvine, CA (United States). 23 Dec 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90363. Order Number DE92011620. Source: OSTI; NTIS; GPO Dep.

Hybrid technologies for reduction of NO_x emissions from coal fired utility boilers may offer greater levels of NO_x control than the sum of the individual technologies, leading to more cost effective emissions control strategies. Energy and Environmental Research Corporation had developed a hybrid NO_x control strategy involving two proprietary concepts which has the potential to meet the US Department of Energy's goal at a significant reduction in cost compared to existing technology. The process has been named CombiNO$_x$. CombiNO$_x$ is the integration of three separate NO control technologies: (1) Gas Reburning, (2) CO-Promoted Selective Non-Catalytic Reduction, and (3) Methanol Injection/NO_2 Scrubbing.

17795 (DOE/PC/90365-T4) **Fundamental mechanisms in flue-gas conditioning: Topical report No. 1, Literature review and assembly of theories on the interactions of ash and FGD sorbents.** Dahlin, R.S.; Vann Bush, P.; Snyder, T.R. Southern Research Inst., Birmingham, AL (United States). 9 Jan 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90365. (SRI-ENV-92-14-7375). Order Number DE92010989. Source: OSTI; NTIS; GPO Dep.

The overall goal of this research project is to formulate a mathematical model of flue gas conditioning. This model will be based on an understanding of why ash properties, such as cohesivity and resistivity, are changed by conditioning. Such a model could serve as a component of the performance models of particulate control devices where flue gas conditioning is used. There are two specific objectives of this research project, which divide the planned research into two main parts. One part of the project is designed to determine how ash particles are modified by interactions with sorbent injection processes and to describe the mechanisms by which these interactions affect fine particle collection. The objective of the other part of the project is to identify the mechanisms by which conditioning agents, including chemically active compounds, modify the key properties of fine fly ash particles.

17796 (DOE/PC/90542-T4) **Clean Coal Technology III (CCT III) 10 MW demonstration of gas suspension absorption: Fourth quarterly technical progress report, July 1, 1991–September 30, 1991.** AIRPOL, Inc., Teterboro, NJ (United States). 7 Feb 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90542. Order Number DE92012644. Source: OSTI; NTIS; GPO Dep.

The Gas Suspension Absorber (GSA) system brings coal combustion gases into contact with a suspended mixture of solids, including sulfur-absorbing lime. After the lime absorbs the sulfur pollutants, the solids are separated from the gases in a cyclone device and recirculated back into the system where they capture additional sulfur pollutant. The cleaned flue gases are sent through a dust collector before being released into the atmosphere. The key to the system's superior economic performance with high sulfur coals is the recirculation of solids. Typically, a solid particle will pass through the system about one hundred times before leaving the system. Another advantage of the GSA system is that a single spray nozzle is used to inject fresh lime slurry. The GSA system is expected to be the answer to the need of the US industry for an effective, economic and space efficient solution to the SO_2 pollution problem.

17797 (DOE/PC/90548-T4) **LIFAC sorbent injection desulfurization demonstration project: Quarterly report No. 4, July–September 1991.** LIFAC North America, Inc., Oakland, CA (United States); ICF Kaiser Engineers, Inc., Pittsburgh, PA (United States); Tampella Power, Tampere (Finland). 6 Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90548. Order Number DE92012560. Source: OSTI; NTIS; GPO Dep.

In December 1990, the US Department of Energy selected 13 projects for funding under the Federal Clean Coal Technology Program (Round III). One of the projects selected was the project sponsored by LIFAC North America, (LIFAC NA), titled "LIFAC Sorbent Injection Desulfurization Demonstration Project." The host site for this $17 million, three-phase project is Richmond Power and Light's Whitewater Valley Unit No. 2 in Richmond, Indiana. The LIFAC technology uses upper-furnace limestone injection with patented humidification of the flue gas to remove 75–85% of the sulfur dioxide (SO_2) in the flue gas. In this report, progress for the period July–September 1991 is covered.

17798 (DOE/PC/91159-T1) **Development of a reburning boiler process model: First quarterly progress report, October 1, 1991–December 31, 1991.** Wu, K.T. Energy and Environmental Research Corp., Irvine, CA (United States). 30 Jan 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91159. Order Number DE92013027. Source: OSTI; NTIS; GPO Dep.

The overall objective of this program is to integrate EER's expertise in boiler reburning performance evaluation into a package of analytical computer tools. Specific objectives of the program are to develop a computational capability with the following features: (1) can be used to predict the impact of gas reburning application on thermal conditions in the boiler radiant furnace, and on overall boiler performance; (2) can estimate gas reburning NO_x reduction effectiveness based on specific reburning configurations and furnace/boiler configurations; (3) can be used as an analytical tool to evaluate the impact of boiler process parameters (e.g., fuel switching and changes in boiler operating conditions) on boiler thermal performance; (4) is adaptable to most boiler designs (tangential and wall fire boilers) and a variety of fuels (solid, liquid, gaseous and slurried fuels); (5) is sufficiently user friendly to be exercisable by engineers with a reasonable knowledge of boilers, and with reasonable computer skills. Here, "user friendly" means that the user will be guided by computer codes during the course of setting up individual input files for the boiler performance model.

17799 (DOE/PC/91337-T1) **An experimental study of NO_x recycle in the NOXSO flue gas cleanup process: Quarterly technical progress report No. 1, September 18–December 31, 1991.** NOXSO Corp., Library, PA (United States). 19 Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91337. Order Number DE92011409. Source: OSTI; NTIS; GPO Dep.

This current project is pilot-scale testing of NO_x recycle. The objective is to provide further fundamental understanding and useful information for its implementation at the Niles station. A Babcock & Wilcox's 6 million Btu/hr Small Boiler Simulator (SBS) has been chosen to perform the tests. The SBS is the same type of cyclone furnace as that at Niles and simulates a large cyclone unit very well. The project involves conducting a series of tests which include injecting NO, NO_2, N_2O, and simulated NO_x recycle stream respectively. The work performed during this reporting period focused on the site preparation, shakedown tests, and baseline tests. The shakedown testing of NO injection into the primary air stream alone and the secondary air stream alone showed promising results. A large amount of NO injected into furnace was destroyed, especially when the NO was injected into the primary air duct. However, the measuring instrumentation needs to be improved to give accurate data.

17800 (DOE/PC–92011471) **PETC Review, Issue 1, March 1990.** Blaustein, B.; Reiss, J.; Martin, G.; Hammer, D.; Mills, J. (eds.). USDOE Pittsburgh Energy Technology Center, PA (United States). Mar 1990. 55p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011471. Source: OSTI; NTIS; GPO Dep.

This issue of PETC Review contains short discussion on the following topics: (1)"SO_2 Control and Duct Injection: A Solution to Acid Rain"–research on duct injection; (2)"Acid Rain Abatement and Advanced Coal Cleaning: A Precombustion Option"–research on selective agglomeration and advanced froth flotation; (3)"Two-Stage Liquefaction of Coal"–PETC's efforts to further the viability of this technology; (4)"Clean Coal Technology: Energy and the Environment"–the Clean Coal Technology Program is demonstrating technologies that show coal can be both efficient and environmentally acceptable. Supplemental sections on events, special focuses, calendars, publication lists, etc. are also included.

17801 (NUTEK-FBT–92-1) **Environmental effects of ashes, VIAK.** Halldin, A. (VIAK AB, Stockholm (Sweden)); Svenstam, G.; Raagfeldt, K. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). [1992]. 38p. (In Swedish). Project NUTEK-276-228. Order Number DE92506602. Source: OSTI; NTIS (US Sales Only); INIS.

On request of the National Energy Administration a study to clarify the leaching of the metals arsenic, cadmium, copper, mercury, molybdenum, and zinc has been carried out. The investigated material have been fly ash from coal and wood separate, mixed together and mixed with sludge of bark. The study was also planned to show or indicate the pH-value at which the leaching of the above-mentioned metals increase. The investigations show that the leaching from both the clean ashes and the mixtures of ash and sludge of bark is fairly low, but that the leaching is partly higher for the mixture compared with the clean ashes. This means that at the disposal site, mixture with organic waste ought to be avoided. Instead the two types of waste can be disposed in layers, which will reduce the leaching in comparison with the achieved results during the leaching tests. 24 figs., 17 tabs.

0109 Environmental Aspects

Refer also to citation(s) 17779, 17800, 17801, 18200, 19121, 19526, 19558

17802 (ANL/ESD/TM–22-Vol.1) **Emissions of greenhouse gases from the use of transportation fuels and electricity: Volume 1, Main text.** DeLuchi, M.A. (California Univ., Davis, CA (United States)). Argonne National Lab., IL (United States). Energy Systems Div. Nov 1991. 142p. Sponsored by USDOE, Washington, DC (United States); Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012102. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents estimates of full fuel-cycle emissions of greenhouse gases from using transportation fuels and electricity. The data cover emissions of carbon dioxide (CO_2), methane, carbon monoxide, nitrous oxide, nitrogen oxides, and nonmethane organic compounds resulting from the end use of fuels, compression or liquefaction of gaseous transportation fuels, fuel distribution, fuel production, feedstock transport, feedstock recovery, manufacture of motor vehicles, maintenance of transportation systems, manufacture of materials used in major energy facilities, and changes in land use that result from using biomass-derived fuels. The results for electricity use are in grams of CO_2-equivalent emissions per kilowatt-hour of electricity delivered to end users and cover generating plants powered by coal, oil, natural gas, methanol, biomass, and nuclear energy. The transportation analysis compares CO_2-equivalent emissions, in grams per mile, from base-case gasoline and diesel fuel cycles with emissions from these alternative- fuel cycles: methanol from coal, natural gas, or wood; compressed or liquefied natural gas; synthetic natural gas from wood; ethanol from corn or wood; liquefied petroleum gas from oil or natural gas; hydrogen from nuclear or solar power; electricity from coal, uranium, oil, natural gas, biomass, or solar energy, used in battery-powered electric vehicles; and hydrogen and methanol used in fuel-cell vehicles.

0120 Mining

17803 (VTT-OPT–28) **Developing of the weather services for peat production.** Karjalainen, T. (Oulu Univ. (Finland). Research Centre of Northern Finland); Kiukaanniemi, E. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Oct 1991. 34p. (In Finnish). Project KTM-275/881/87. Order Number DE92506475. Source: OSTI; NTIS (US Sales Only).

OPTIMITURVE Research Programme.

The aim of this project was to determine the development alternatives of weather forecasting services for peat production. Two different radar systems, the weather radar and marine radar, have been chosen for this research. The delivery costs of a small sized marine radar are low (60 000 FIM), so it might be used as working site equipment on largest production areas. The modern weather radar is more expensive, and hence it might be used as the basic equipment for a regional rain warning system. An alternative for regional system is to develop the peat weather forecast to be a more real-time forecast than before. An operable information delivery network is essential for a regional rain warning system, by which a warning for rain threat can be delivered to production control fast. The both chosen alternatives are tested in this research. Especially, the results obtained from small sized marine radar have been positive. The obtained benefits are based on s.c. safety ridging method, in which the part of the harvest that best fulfills the moisture and quality requirement is saved. The benefit of an operable rain warning system is estimated to be about 30 FIM/ha for the peat contractor, and 300 FIM/ha/a for the producing company in the form of increased production. The value of the additional production, however, depends on the internal calculation basis of the production company.

17804 (VTT-OPT–36) **Development of pneumatic harvesting technology.** Tervo, M. (Oulu Univ. (Finland). Research Centre of Northern Finland). Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Nov 1991. 20p. (In Finnish). Order Number DE92506478. Source: OSTI; NTIS (US Sales Only).

OPTIMITURVE Research Programme.

The collecting capacity and time consuming of present pneumatic harvesters have been studied in this research on field conditions. The guidelines for future development of pneumatic harvesting method have also been presented. Operational efficiency measurements of pneumatic harvesters were carried out using seven different harvesters. The average of the hectare yield of the most efficient harvester was measured to be 17.2 t/ha and the capacity 7.2 kg/s. According to the measurements the yields were extremely low, the best yields being only 36 %, which means that 64 % of the milled layer remained on the field. Because it is possible to increase the collecting efficiency and decrease the power demand and dust emissions of a pneumatic harvester remarkably using activation of the milled layer, the target should be development of a pneumatic harvester equipped with activator of the milled layer. The pneumatic harvester should also be equipped with miller, so the drying energy supplied by the sun could be maximally utilized.

17805 (VTT-OPT-38) **Development of a measuring method for production efficiency.** Paappanen, T.; Lindh, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Dec 1991. 66p. (In Finnish). Project KTM-275/881/87. Order Number DE92506480. Source: OSTI; NTIS (US Sales Only).

OPTIMITURVE Research Programme.

This report describes the methods for studying the production efficiency of milled peat production. In this context the production efficiency can be defined as the utilization degree of different factors of peat production. The main factors effecting on peat production are the number and efficiency of production equipment, the weather and the field conditions. Two different methods were used for determination of production efficiency, the statistical treatment of climatic data and numerical simulation. Both methods were used to study production efficiency of four production areas located in different parts of Finland. According to the results, the production efficiency has increased by about 20-40 % during 1980s for most of the studied areas. Both methods can be used to study production efficiency. However, numerical simulation is more versatile compared with statistical methods. The prediction ability of real production is about the same on both methods.

0130 Transport, Handling, and Storage

Refer also to citation(s) 17865, 17866

17806 (CONF-9110369–) **Joint DOE/NSF workshop on flow of particulates and fluids: Proceedings.** Plasynski, S.I. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Peters, W.C. (eds.); Roco, M.C. (ed.). USDOE Pittsburgh Energy Technology Center, PA (United States); National Science Foundation, Washington, DC (United States). [1991]. 396p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). From 3. Joint Department of Energy/National Science Foundation (DOE/NSF) workshop on flow of particulates and fluids; Worcester, MA (United States); 22-24 Oct 1991. Order Number DE92012692. Source: OSTI; NTIS; GPO Dep.

These proceedings are the result of the third DOE-NSF Workshop on fundamental research in the area of particulate two-phase flow and granular flow. The present collection of 23 contributions from universities and national laboratories is based on research projects sponsored by either the Department of Energy or the National Science Foundation. These papers illustrate some of the latest advancements in theory, simulations, and experiments. The papers from the Workshop held October 22–24, 1991 have been separated into three basic areas: experiments, theory, and numerical simulations. A list of attendees at the workshop is included at the end of the proceedings. Topics discussed include multiphase flow, slurry flow, particle fluidization, properties of suspensions, boundary value problems, numerical simulation. (VC)

17807 (DOE/PC/90185–T4) **[Kinetic theory and boundary conditions for flows of highly inelastic spheres]: Quarterly progress report, October 1, 1991–December 31, 1991.** Richman, M.W. Worcester Polytechnic Inst., MA (United States). [1991]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90185. Order Number DE92012645. Source: OSTI; NTIS; GPO Dep.

In this quarter we accomplished two milestones. First, we qualitatively compared the approximate solutions for gravity-driven granular flows down bumpy inclines obtained by Richman and Marciniec [1990] to the experimental results for the same flows obtained by Johnson and Jackson [1990]. The comparison was made by employing the reparameterized solutions of Richman and Marciniec [1990] and by analyzing several angles of inclination, coefficients of restitution, and boundary geometries. Next, we obtained exact numerical solutions of the equations of motion that were solved approximately by Richman and Marciniec [1990]. We found that there are flow rates at which two flows are possible. Of the two, the less massive is more dilute, more thermalized, and faster than its more massive counterpart. In addition we found that the approximate results obtained by Richman and Marciniec [1990] for the same flows are in reasonable agreement with the numerical solutions. The numerical work is outlined in detail in the report. (VC)

17808 (DOE/PC/91297–T1) **A computational model for coal transport and combustion: Quarterly technical progress report, December 1, 1991–February 28, 1992.** Ahmadi, G. Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering. [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91297. Order Number DE92012553. Source: OSTI; NTIS; GPO Dep.

In the period of December 1, 1991 to February 28, 1992 further progress has been made in formulation of the thermodynamically consistent rate dependent model for turbulent two-phase flows. The thermodynamically admissible constitutive equations were derived, and the case of a simple shear flow was also studied. A stress transport model for rapid granular flows in a rotating frame of reference was formulated. The thermodynamically consistent constitutive equations were derived. It was shown that the model contains the existing kinetic theories as special limiting cases. The model predictions for the special case of rapid simple shear flows were compared with the available simulation data. The kinetic model for rapid flows of granular materials, which includes frictional losses, was used for studying several parallel shear flows. These include Couette and gravity flows. Progress has been made in developing a computational model for rapid granular flows in complex geometries. The design for the experimental simple shear flow device was also improved, and the construction of the device was initiated.

0140 Combustion

Refer also to citation(s) 17707, 17732, 17733, 17760, 17784, 17785, 17794, 17798, 17799, 17808, 18173, 18272, 18273, 18280, 18656

17809 (ANL–91/4) **Materials performance in the atmospheric fluidized-bed cogeneration air heater experiment.** Natesan, K. (Argonne National Lab., IL (United States)); Podolski, W.; Wang, D.Y.; Teats, F.G.; Gerritsen, W.; Stewart, A.; Robinson, K. Argonne National Lab., IL (United States). Feb 1991. 242p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92011867. Source: OSTI; NTIS; GPO Dep.

The Atmospheric Fluidized-Bed Cogeneration Air Heater Experiment (ACAHE) sponsored by the US Department of Energy (DOE) was initiated to assess the performance of various heat-exchanger materials to be used in fluidized-bed combustion air heater systems. Westinghouse Electric Corporation, through subcontracts with Babcock & Wilcox, Foster Wheeler, and ABB Combustion Engineering Systems, prepared specifications and hardware for the ACAHE tests. Argonne National Laboratory contracted with Rockwell International to conduct tests in the DOE atmospheric fluidized-bed combustion facility. This report presents an overview of the project, a description of the facility and the test hardware, the test operating conditions, a summary of the operation, and the results of analyzing specimens from several uncooled and cooled probes exposed in the facility. Extensive microstructural analyses of the base alloys, claddings, coatings, and weldments were performed on specimens exposed in several probes for different lengths of time. Alloy penetration data were determined for several of the materials as a function of specimen orientation and the exposure location in the combustor. Finally, the data were compared with earlier laboratory test data, and the long-term performance of candidate materials for air-heater applications was assessed.

17810 (ANL/CP–75224) **Materials performance in fluidized-bed air heaters.** Natesan, K.; Podolski, W. Argonne National Lab., IL (United States). Dec 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920458–5: Corrosion '92 conference and exhibition, Nashville, TN (United States), 27 Apr - 1 may 1992). Order Number DE92010888. Source: OSTI; NTIS; GPO Dep.

Development of cogeneration systems that involve combustion of coal in a fluidized bed and use of air heaters to generate hot air for turbine systems has been in progress for a number of years. The

US Department of Energy (DOE) sponsored the Atmospheric Fluidized-Bed Cogeneration Air Heater Experiment (ACAHE) to assess the performance of various heat exchanger materials and establish confidence in the resultant designs of fluidized-bed-combustion air heater systems. Westinghouse Electric Corporation, in association with Babcock & Wilcox, Foster Wheeler, and ABB/Combustion Engineering, prepared specifications and hardware for the ACAHE. Argonne National Laboratory, through a contract with the Rocketdyne Division of Rockwell International, conducted tests in the DOE 1.8 × 1.8 m atmospheric fluidized-bed combustion facility in El Segundo, California. This paper presents an assessment of the materials performance in fluidized bed environments and examines guidelines for materials selection on the basis of corrosion resistance in air and in combustion environments, mechanical properties, fabricability/thermal stability, and cost.

17811 (CONF-910902–13) **Flow dynamics of ash deposition in heat-exchanger tube banks.** Shaffer, F.; Ekmann, J.; Mathur, M. USDOE Pittsburgh Energy Technology Center, PA (United States). Coal Combustion Div. [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). From 1991 international conference on coal science; Newcastle upon Tyne (United Kingdom); 16-20 Sep 1991. Order Number DE92011749. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to generate experimental data to describe flow fields in heat-exchanger tube banks. One of the main applications of this data is in the evaluation of computational fluid dynamics (CFD) models which are an important part of an ash deposition model. The CFD models under evaluation include a large eddy simulation (LES) being developed by Textron Inc. under DOE-PETC funding and the CLEW code developed at the University of California at Berkeley. Various CFD modeling approaches, e.g., implementation of a transition-to-turbulence and modified wall functions, are also being tested using the PHOENICS code.

17812 (CRIE-W–90023) **Coal combustion characteristics in oxygen enriched atmosphere.** Koyata, K. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Oki, H.; Tanaka, T.; Kika, N.; Suzuki, K.; Tamura, M. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Apr 1991. 49p. (In Japanese). Order Number DE92514554. Source: OSTI; NTIS (US Sales Only).

Central Research Institute of Electric Power Industry and Ishikawajima-Harima Heavy Industries take notice of a technology of the coal combustion in the oxygen enriched atmosphere and study its fundamental combustion characteristics, as a part of improvement of operation characteristics in the coal-fired power plant and the technology of CO_2 recovery from flue gas. The combustion characteristics are examined using an electric furnace type reaction tube combustion experimental system (reaction temperature is constant at 1200°C). Combustion efficiency of pulverized coal makes no changes even in replacing N_2 in air for combustion with CO_2. When a ratio of O_2 in gas increases under this condition, pulverized coal becomes easy to ignite and also increases in combustion efficiency. When the pulverized coal is burnt in a $O_2 + CO_2$ flow, a conversion ratio of N in fuel to NO_x decreases about 30% as compared with that in combustion in air flow. Moreover, this NO_x conversion ratio decreases rapidly under the fuel excess condition. Properties of flue gas in the combustion in the oxygen enriched atmosphere are CO_2, H_2O and O_2. Since main component of flue gas is CO_2 (90% or more), CO_2 recovery becomes easy. 11 refs., 35 figs., 8 tabs.

17813 (DOE/MC/21023–92/C0015) **Second-generation pressurized fluidized bed combustion.** Wolowodiuk, W.; Robertson, A. Foster Wheeler Development Corp., Livingston, NJ (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. (CONF-920427–1: Energy and environment: transitions in Eastern Europe, Prague (Czechoslovakia), 20-23 Apr 1992). Order Number DE92012133. Source: OSTI; NTIS; GPO Dep.

Under the sponsorship of the United States Department of Energy, Foster Wheeler Corporation is developing second-generation pressurized fluidized bed combustion (PFBC) power plant technology that will enable this type of plant to operate with net plant efficiencies in the range of 43 to 46 percent (based on the higher heating value of the coal), with a reduction in the cost of electricity of at least 20 percent. A three-phase program is under way. Its scope encompasses the conceptual design of a commercial plant through the process of gathering needed experimental test data to obtain design parameters.

17814 (DOE/METC/C–92/7013) **Modeling deterministic chaos in thermally-pulsed combustion.** Daw, C.S. (Oak Ridge Associated Universities, Inc., TN (United States)); Thomas, J.F.; Richard, G.A. USDOE Morgantown Energy Technology Center, WV (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). (CONF-9204103–2: The Combustion Institute, central states spring meeting on combustion fundamentals and applications, Columbus, OH (United States), 26-28 Apr 1992). Order Number DE92011756. Source: OSTI; NTIS; GPO Dep.

Can chaotic behavior occur in combustion systems? In practical combustion systems, mixing processes are governed by turbulent transport, which is itself chaotic in nature.l However, in an ideally mixed combustor, the question remains: can chaotic behavior occur? The present paper demonstrates that even neglecting the mixing process, chaotic responses are possible in a "thermal" pulse combustor. While this result is limited only to thermal pulse combustion, it suggests that chaotic behavior (apart from turbulent mixing) may exist in other practical combustion systems. The resulting fluctuations in reaction rates, concentrations and temperature may play a role in fluctuating levels of emissions such as NO_x. (VC)

17815 (DOE/PC/79743–T3) **Mechanisms governing fine particulate emissions from coal flames: Quarterly technical progress reports Nos. 3 and 4, April 1, 1988–September 30, 1988.** Clark, W.D. (Energy and Environmental Research Corp., Irvine, CA (United States)); Chen, S.L.; Kramlich, J.C.; Newton, G.H.; Seeker, W.R.; Samuelsen, G.S. Energy and Environmental Research Corp., Irvine, CA (United States). Nov 1988. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79743. Order Number DE92013483. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this project are to provide a basic understanding of the principal processes that govern fine particulate formation in pulverized coal flames, and develop procedures to predict the levels of emission of fine particles from pulverized coal combustors. (VC)

17816 (DOE/PC/88654–T4) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 3, November 1989–January 1990.** Combustion Engineering, Inc., Windsor, CT (United States). Mar 1990. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE92011580. Source: OSTI; NTIS; GPO Dep.

This three-year research project at Combustion Engineering, Inc. (CE), will assess the potential economic and environmental benefits derived from coal beneficiation by various advanced cleaning processes. The objectives of this program include the development of a detailed generic engineering data base, comprised of fuel combustion and ash performance data on beneficiated coal-based fuels (BCFs), which is needed to permit broad application. This technical data base will provide detailed information on fundamental fuel properties influencing combustion and mineral matter behavior as well as quantitative performance data on combustion, ash deposition, ash erosion, particulate collection, and gaseous and particulate emissions. Program objectives also address the application of this technical data base to predict performance impacts associated with firing BCFs in various commercial boiler designs as well as assessment of the economic implications of BCF utilization. Additionally, demonstration of this technology, with respect to large-scale fuel preparation, firing equipment operation, fuel performance, environmental impacts, and verification of prediction methodology, will be provided during field testing.

17817 (DOE/PC/88654–T5) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 5, May 1990–June 1990.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Aug 1990. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE92012642. Source: OSTI; NTIS; GPO Dep.

The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, conbustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. Subcontractors to CE to perform parts of the test work are the Massachusetts Institute of Technology (MIT), Physical Sciences, Inc. Technology Company (PSIT) and the University of North Dakota Energy and Environmental Research Center (UNDEERC). Twenty fuels will be characterized during the three-year base program: three feed coals, fifteen BCFs, and two conventionally cleaned coals for the full-scale tests. Approximately nine BCFs will be in dry ultra-fine coal (DUC) form, and six BCFs will be in coal-water fuel (CWF) form. Additional BCFs would be characterized during optional project supplements.

17818 (DOE/PC/89659-T8) **Coal reburning for cyclone boiler NO$_x$ control demonstration: Quarterly report No. 7, October, November, and December 1991.** Haggard, R.W. Jr. Babcock and Wilcox Co., Cassville, WI (United States). [1991]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89659. Order Number DE92012554. Source: OSTI; NTIS; GPO Dep.

It is the objective of the Coal Reburning for Cyclone Boiler NOx Control Project to fully establish that the coal reburning clean coal technology offers cost-effective alternatives to cyclone operating electric utilities for overall oxides of nitrogen control. The project will evaluate the applicability of the reburning technology for reducing NOx emissions in full scale cyclone-fired boilers which use coal as a primary fuel. The performance goals while burning coal are: (1) Greater than 50 percent reduction in NOx emissions, as referenced to the uncontrolled (baseline) conditions at full load. (2) No serious impact on cyclone combustor operation, boiler efficiency or boiler fireside performance (corrosion and deposition), or boiler ash removal system performance.

17819 (DOE/PC/89774-T3) **Effects of catalytic mineral matter on CO/CO$_2$ ratio, temperature and burning time for char combustion: Quarterly progress report No. 9, October-December 1991.** Longwell, J.P.; Sarofim, A.F.; Lee, Chun-Hyuk; Modestino, A.J.; Cho, C. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Chemical Engineering. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89774. Order Number DE92011581. Source: OSTI; NTIS; GPO Dep.

In this program we are measuring the CO$_2$/CO ratio for both catalyzed and uncatalyzed chars over a wide range of temperature. These results will than be used to develop predictive models for char temperature and burning rates. The electrodynamic balance has been successfully used to make such measurements for single 200 mm spherocarb particles. In this report progress on the laser heating and the theoretical modeling are reported. (VC)

17820 (DOE/PC/90545-T4) **Full scale demonstration of low-NO$_x$ cell burner retrofit: Public design report.** Babcock and Wilcox Co., Barberton, OH (United States). Energy Services Div. 9 Aug 1991. 91p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90545. Order Number DE92009768. Source: OSTI; NTIS; GPO Dep.

The overall objective of the Full-Scale Demonstration of Low-NO$_x$ Cell Burner Retrofit project is to demonstrate the cost-effective reduction of NO$_x$ generated by a large based-loaded (70% capacity factor or greater), coal-fired utility boiler. Specific objectives include: (1) At least 50% NO$_x$ reduction over standard two-nozzle cell burners, without degradation of boiler performance or life; (2) Acquire and evaluate emission and boiler performance data before and after the retrofit to determine NO$_x$ reduction and impact on overall boiler performance; (3) Demonstrate that the retrofit of Low-NO$_x$ Cell Burners in boilers currently equipped with cell burners, is a cost-effective alternative to any other emerging, or commercially-available, NO$_x$ control technology.

17821 (DOE/PC-92011472) **PETC Review, Issue 2, September 1990.** Blaustein, B.; Reiss, J.; Riehle, B.; Brown, J.; Hammer, D. (eds.). USDOE Pittsburgh Energy Technology Center, PA (United States). Sep 1990. 55p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011472. Source: OSTI; NTIS; GPO Dep.

This issue of PETC Review provides short discussion on research programs in (1) combustion technology, (2) flue gas cleanup technology, (3) coal science and chemistry. An overview of the PETC New Fuels Evaluation Facility is given, the US Clean Coal Technology Program's activities in Poland are discussed, and the NOXSO flue gas cleanup process is outlined. Supplemental sections on events, special focuses, publication listings, etc. are also included.

17822 (DOE/PC-92011597) **PETC Review, Issue 4, Fall 1991.** Blaustein, B.D.; Reiss, J.; Tarquinio, M.A.; Brown, J.; Evans, E. (eds.). USDOE Pittsburgh Energy Technology Center, PA (United States). Fal 1991. 53p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011597. Source: OSTI; NTIS; GPO Dep.

In this issue of PETC Review, short discussion is given on the following topics: (1) "Combustion 2000"–a low-emission boiler system coupled to a high-performance power system; (2) "Liquid Transportation Fuels from Coal, Part 2: Indirect Liquefaction"–outline research program; (3) "A Computer Expert System to Reduce Power Plant Emissions"–a system being developed to predict the economic, operational, and environmental benefits of using commercially achievable cleaned coals; (4) "PETC's Flow Analysis Laboratory Assists Artificial Heart Research"–PETC equipment used to study the flow of blood in artificial hearts. Supplemental sections on events, special focuses, calendars, publication lists, etc. are also included.

17823 (SAND-91-8715) **The temperature, burning rates and char character of pulverised coal particles prepared from maceral concentrates.** Wall, T.F. (Newcastle Univ. (Australia). Dept. of Chemical Engineering); Tate, A.G.; Bailey, J.G.; Jenness, L.G.; Mitchell, R.E.; Hurt, R.H. Sandia National Labs., Livermore, CA (United States); Newcastle Univ. (Australia). Dept. of Chemical Engineering. [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920707-6: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006465. Source: OSTI; NTIS; GPO Dep.

Maceral concentrates, extracted by selective sampling from the coal face, were burnt as pulverised fuel in order to obtain the temperatures of many hundred individual particles of pulverised coal at several combustion times by two-colour pyrometry. The concentrate having a 93.7% vitrinite-rich analysis generates chars of the fine walled cenospheres, with openings in the walls, which burn at high temperature, whereas the concentrate with a 89.2% inertinite-rich analysis generates chars of lower porosity and higher density which burn at a lower, and more uniform, temperature. The vitrinite-rich concentrate also burns with an increasing spread in the population of particle temperatures, the inertinite-rich concentrate burns with a decrease in this spread. Due to higher char densities and lower reactivities the burning times of the inertinite-rich concentrate is estimated to be from 2.9 to 3.8 times that of the vitrinite-rich concentrate. Reactivity distributions are estimated from the temperature populations by fixing the activation energy of the chemical rate coefficient and allowing the pre-exponential factor to accommodate the reactivity spread. An increase in the spread of the estimated distributions is evident at high burnoffs.

17824 (SAND-91-8716) **Unified high-temperature char combustion kinetics for a suite of coals of various rank.** Hurt, R.H.; Mitchell, R.E. Sandia National Labs., Livermore, CA (United States). [1991]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707-12: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006698. Source: OSTI; NTIS; GPO Dep.

This article summarizes the results of a series of combustion kinetic investigations on chars from a suite of ten US coals of various rank. An optical technique was used to measure in situ single-particle sizes, temperatures, and velocities, from which combustion rates were computed using a model of gas-particle transport processes. Combustion rates were also determined independently by an inorganic tracer technique based on chemical analysis of extracted samples. The data set was acquired in a single experimental facility, using a standardized experimental procedure, and was analyzed in a uniform way to allow direct comparisons between coals. A pronounced trend is evident in the data set; char reactivity decreases with increasing carbon content of the parent coal. A unified treatment of this data set is presented, culminating in a rank-dependent reactivity correlation, allowing the prediction of char combustion rates for a range of coals under conditions relevant to pulverized coal fired combustors.

17825 (SAND–91-8717) **On the combustion kinetics of heterogeneous char particle populations.** Hurt, R.H.; Mitchell, R.E. Sandia National Labs., Livermore, CA (United States). [1991]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–8: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006681. Source: OSTI; NTIS; GPO Dep.

A laboratory-scale laminar flow reactor is used to measure coal char combustion rates under conditions simulating those found in pulverized coal-fired boilers. The temperatures, sizes, and velocities of individual burning pulverized coal char particles are measured in situ with a unique optical technique. The optical data are used to determine global, n^{th}-order Arrhenius-form kinetic parameters describing char oxidation. In the present article, single-particle rate coefficients are computed from optical measurements on Pocahontas #3 coal char and techniques for the determination of kinetic parameters from the single-particle coefficients are investigated.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 18655, 18656

17826 (DOE/FE–0244P) **Biennial Supplement to The Directory of US Coal & Technology Export Resources.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Planning and Environment. Oct 1991. 147p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012429. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this directory is to provide a listing of available US coal and coal related resources to potential purchasers of those resources abroad. The directory lists business entities within the United States which offer coal related resources, products and services for sale on the international market. Each listing is intended to describe the particular business niche or range of product and/or services offered by a particular company. The listing provides addresses, telephones, and telex/fax for key staff in each company committed to the facilitation of international trade. The content of each listing has been formulated especially for this directory and reflects data current as of the date of this edition.

17827 (DOE/METC/C–92/7016) **Impact of clean coal technologies post-2000 electric power generation markets.** Tomer, B.J.; Mahajan, K.; Hand, T.J.; Graham, L.E. USDOE Morgantown Energy Technology Center, WV (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). (CONF-920432–8: 54. annual American power conference, Chicago, IL (United States), 13-15 Apr 1992). Order Number DE92011754. Source: OSTI; NTIS; GPO Dep.

The electric power generation markets will be undergoing significant changes between now and the year 2000. Many of the forces that will effect these changes are as yet undefined. The passage of the 1990 Clean Air Act Amendments has removed some uncertainties (allowable sulfur emission limits, the allowance system, identification of air toxics) but has created some new uncertainties (NO_x limits, value of allowances, rules for air toxics). Current projections of needed generating capacity additions require that decisions will need to be made within the next 5 to 10 years for construction of significant amounts of capacity. This paper presents a brief summary of the projected size of the post-2000 market and shows how advanced clean coal technologies might penetrate those markets.

0170 Legislation and Regulations

Refer also to citation(s) 17827

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 17838, 17839, 17840

17828 (LA–12283-SR) **Oil Recovery Technology Partnership: The first two years: Biennial report for fiscal years 1989–1990.** Hanold, R.J. (Los Alamos National Lab., NM (United States)); Northrop, D.A. Los Alamos National Lab., NM (United States); Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ;AC04-76DP00789. Order Number DE92013556. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) has supported a new initiative to put the domestic oil industry (majors, independents, and service companies) in a position to use the scientific and engineering resources of the DOE laboratories, especially the weapons laboratories, to acquire new technologies for improved oil recovery. With the support of DOE, Los Alamos National Laboratory and Sandia National Laboratories have initiated an Oil Recovery Technology Partnership that will apply federal investments in science and technology toward improving domestic oil recovery. This biennial report summarizes progress that has been made by the Oil Recovery Technology Partnership in FY89–90, the first two years of its operation. Results are presented for the following Partnership projects: (1) Stresses and Fractures in a Low-Permeability Oil Reservoir, (2) Microseismic Monitoring of the Chaveroo and Tomahawk Oil Fields, New Mexico, (3) Development of a Multistation Borehole Seismic Receiver, (4) Imaging the Faults in the McKittrick Oil Field, and (5) other activities conducted in response to industry requests. In addition, Partnership interactions with industry and possible Partnership activities in the future are summarized.

17829 (LA-UR–92-895) **Oxalate complexation with aluminum(III) and iron(III) at moderately elevated temperatures.** Tait, C.D. (Los Alamos National Lab., NM (United States)); Janecky, D.R.; Clark, D.L.; Bennett, P.C. Los Alamos National Lab., NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920761–12: 7. water-rock interaction conference, Park City, UT (United States), 9-23 Jul 1992). Order Number DE92011361. Source: OSTI; NTIS; GPO Dep.

To add to our understanding of the weathering of rocks in organic rich environments such as sedimentary brines and oil field waters, we have examined the temperature dependent complexation of aluminum with oxalate. Raman vibrational studies show that even the association constant for the highly charged $Al(ox)_3^{3-}$ unexpectedly increases with moderate temperature increases to 80°C. To evaluate the potential importance of these Al-oxalate species in complex natural systems, temperature dependent competition experiments Fe(III) and Al(III) for oxalate have been initiated. Similar to aluminum, ferric oxalates show increases in association constants at higher temperatures. In competition experiments, the first association constant for $Fe(ox)^+$ increases faster than that for $Al(ox)^+$ to 90°C.

17830 (NIPER–575) **Integrated geological-engineering model of Patrick Draw field and examples of similarities and differences among various shoreline barrier systems.** Schatzinger, R.A.; Szpakiewicz, M.J.; Jackson, S.R.; Chang, M.M.; Sharma, B.; Tham, M.K.; Cheng, A.M. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Apr 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92001037. Source: OSTI; NTIS; GPO Dep.

The Reservoir Assessment and Characterization Research Program at NIPER employs an interdisciplinary approach that focuses on the high priority reservoir class of shoreline barrier deposits to: (1) determine the problems specific to this class of reservoirs by identifying the reservoir heterogeneities that influence the movement and trapping of fluids; and (2) develop methods to characterize effectively this class of reservoirs to predict residual oil saturation (ROS) on interwell scales and improve prediction of the flow patterns of injected and produced fluids. Accurate descriptions of the spatial distribution of critical reservoir parameters (e.g., permeability, porosity, pore geometry, mineralogy, and oil saturation) are essential for designing and implementing processes to improve sweep efficiency and thereby increase oil recovery. The methodologies and models developed in this program will, in the near- to mid-term, assist producers in the implementation of effective reservoir management strategies such as location of infill wells and selection of optimum enhanced oil recovery methods to maximize oil production from their reservoirs.

17831 (NIPER–581) **Three-phase permeabilities and other characteristics of 260-mD fired Berea.** Maloney, D.; Brinkmeyer, A. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Apr 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92001036. Source: OSTI; NTIS; GPO Dep.

A laboratory investigation was conducted to determine relative permeabilities and other characteristics of a 260-mD fired Berea sandstone. The mineralogical and physical characteristics of the sample were characterized by XRD tests, thin section analyses, mercury injection tests, and centrifuge capillary pressure and wettability tests. Two-phase oil/water relative permeabilities were measured under several stress conditions. Resistivity characteristics of the sample were also evaluated during several of the oil/water tests. Oil/gas and gas/water relative permeabilities were measured during steady-state tests. Three-phase steady-state oil/gas/water tests were performed for six DDI saturation trajectories (decreasing brine and oil saturations, increasing gas saturation) in which the sample was not cleaned between saturation trajectories.

17832 (SAND–91-2575) **Effects of cavern spacing and pressure on subsidence and storage losses for the US Strategic Petroleum Reserve.** Ehgartner, B. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013682. Source: OSTI; NTIS; GPO Dep.

The effects of cavern spacing and operating pressure on surface subsidence and cavern storage losses were evaluated using the finite- element method. The base case for the two sensitivity studies was a typical SPR cavern. The predicted responses of the base case and those from the pressurization study compared quite closely to measured surface subsidence and oil pressurization rates. This provided credibility for the analyses and constitutive models used. Subsidence and cavern storage losses were found to be strongly influenced by cavern spacing and pressurization. The relationship between subsidence volume and losses in storage volume varied as cavern spacing and operating pressure deviated from the base case. However, for a typical SPR cavern subsidence volume is proportional to storage loss and when expressed in ft., subsidence is equal to the percentage of storage loss.

17833 **Single-well internally calibrated method for determining residual oil saturation.** Tang, J.S.; Wood, K.N.; Harker, B.C. 9 Sep 1991. Filed date 9 Mar 1990. Canada Patent patent application 2011911. 14p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A process is provided in which fluid saturations of a hydrocarbon-containing formation are determined by injecting a fluid containing at least one pair of nearly identical tracers into the formation. The tracers constituting this pair have essentially identical chemical and physical properties. The first tracer used in the process of the invention is a chemical compound with labile, exchangeable hydrogen. The second tracer is the same compound except that the hydrogen has been replaced by a hydrogen isotope. In practising the method of the invention, the pair of tracers is injected into a well, allowed to soak, and then produced back through the same well. While in the reservoir, the second tracer exchanges its hydrogen isotope for hydrogen in the water phase. The exchange can only take place while the hydrogen isotope tracer is in the water phase. The extent of exchange of the hydrogen isotope for hydrogen will depend on the relative amounts of water and oil phases in the reservoir. Since the two tracers have identical chemical and physical properties, there is no need for precise knowledge of losses and dispersion effects. The use of the first tracer serves as an internal standard for loss and dispersion calibration. The residual oil concentration can be directly calculated for each produced reservoir sample by knowing the relative amounts of injected and produced tracers, their partition coefficient, the water phase hydrogen isotope exchange rate, and the time that the tracers were in the reservoir.

0203 Drilling and Production

Refer also to citation(s) 17828, 17830, 17831, 18656

17834 (DOE/BC/14260–10-App.-Vol.1) **Measuring wellbore heat losses in active steam injection well: Appendix, Survey and measurement data: Volume 1.** Traynor, B.V. Kawasaki Thermal Systems, Inc., Bakersfield, CA (United States). Apr 1992. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14260. Order Number DE92001024. Source: OSTI; NTIS; GPO Dep.

This work serves as appendices containing survey and measurement data for the report "Measuring Wellbore Heat Losses in Active Steam Injection Well." Appendix 1 outlines survey task, contacts and references; Appendix 2 contains test case data on tubing.

17835 (DOE/BC/14260–10-App.-Vol.2) **Measuring wellbore heat losses in active steam injection well: Appendix, Software development data: Volume 2.** Traynor, B.V. Kawasaki Thermal Systems, Inc., Bakersfield, CA (United States). Apr 1992. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14260. Order Number DE92001025. Source: OSTI; NTIS; GPO Dep.

This work serves as an appendix for the report "Measuring Wellbore Heat Losses in Active Steam Injection Well." The appendix contains data for test cases of different casing conditions, with graphs of casing temperature vs. depth for each test case.

17836 (DOE/CE/15517–T2) **Instrumentation of dynamic gas pulse loading system: Technical progress report, first quarter 1992.** Mohaupt, H. Servo-Dynamics, Inc., Santa Barbara, CA (United States). 14 Apr 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15517. Order Number DE92011617. Source: OSTI; NTIS; GPO Dep.

The overall goal of this work is to further develop and field test a system of stimulating oil and gas wells, which increases the effective radius of the well bore so that more oil can flow into it, by recording pressure during the gas generation phase in real time so that fractures can be induced more predictably in the producing formation. Task 1: Complete the laboratory studies currently underway with the prototype model of the instrumentation currently being studied. Task 2: Perform field tests of the model in the Taft/Bakersfield area, utilizing operations closest to the engineers working on the project, and optimize the unit for various conditions encountered there. Task 3: Perform field test of the model in DGPL jobs which are scheduled in the mid-continent area, and optimize the unit for downhole conditions encountered there. Task 4: Analyze and summarize the results achieved during the complete test series, documenting the steps for usage of downhole instrumentation in the field, and compile data specifying use of the technology by others. Task 5: Prepare final report for DOE, and include also a report on the field tests completed. Describe and estimate the probability of the technology being commercialized and in what time span. The project has made substantial technical progress, though we are running about a month behind schedule. Expenditures are in line with the schedule. Increased widespread interest in the use of DGPL stimulation has kept us very busy. The computer modeling and test instrumentation developed under this program is already being applied to commercial operations.

17837 (NEI-NO–216) **Studies of fundamental parameters affecting secondary and tertiary oil recovery, using a nuclear imaging technique on long-core flow-rigs.** Graue, A. Bergen

Univ. (Norway). 1990 217p. Order Number DE92506560. Source: OSTI; NTIS (US Sales Only).

This thesis reports on research on multiphase flow in porous media using a nuclear tracer technique for measurements of local fluid saturation distributions during core displacement experiments. The thesis presents the radioactive imaging technique, and the development, design and construction of the equipment needed for imaging long-core flood displacements are documented. The equipment has been automated and the instrumentation and data processing are described. Further, a documentation of the application of the equipment is presented, with emphasis on studies of basic parameters governing the fluid flow through porous media. The experimental developments also include the construction of a vertical flow-rig, operating with the nuclear tracer technique. This apparatus is designed for studies of gravity effects on petroleum recovery, but has been further developed to also being capable of scanning in two directions, introducing the possibilities for two dimensional imaging. The phenomenological studies adress both miscible and immiscible displacements, but emphasis has been on two phase immiscible displacements. Water injection during secondary recovery and the impacts by varying the various reservoir parameters have been evaluated. However, also tertiary recovery has been investigated, especially with respect to surfactant injection. The thesis includes studies of the effects of interfacial tensions, both in chemical flooding and in gas gravity drainage. The imaging technique has been used both on the horizontal flow-rig in two- and three-phase core flood experiments and in the vertical rig for studies of gravity assisted production. 225 refs., 75 figs., 18 tabs.

17838 (NIPER–573) **Development of general inflow performance relationships (IPR's) for slanted and horizontal wells producing heterogeneous solution-gas drive reservoirs.** Cheng, A.M. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Apr 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92001035. Source: OSTI; NTIS; GPO Dep.

Since 1968, the Vogel equation has been used extensively and successfully for analyzing the inflow performance relationship (IPR) of flowing vertical wells producing by solution-gas drive. Oil well productivity can be rapidly estimated by using the Vogel IPR curve and well outflow performance. With recent interests on horizontal well technology, several empirical IPRs for solution-gas drive horizontal and slanted wells have been developed under homogeneous reservoir conditions. This report presents the development of IPRs for horizontal and slanted wells by using a special vertical/horizontal/slanted well reservoir simulator under six different reservoir and well parameters: ratio of vertical to horizontal permeability, wellbore eccentricity, stratification, perforated length, formation thickness, and heterogeneous permeability. The pressure and gas saturation distributions around the wellbore are examined. The fundamental physical behavior of inflow performance for horizontal wells is described.

17839 (NIPER–583) **Enhanced oil recovery projects data base.** Pautz, J.F.; Sellers, C.A.; Nautiyal, C.; Allison, E. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Apr 1992. 413p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92001039. Source: OSTI; NTIS; GPO Dep.

A comprehensive enhanced oil recovery (EOR) project data base is maintained and updated at the Bartlesville Project Office of the Department of Energy. This data base provides an information resource that is used to analyze the advancement and application of EOR technology. The data base has extensive information on 1,388 EOR projects in 569 different oil fields from 1949 until the present, and over 90% of that information is contained in tables and graphs of this report. The projects are presented by EOR process, and an index by location is provided.

17840 (NIPER–593) **[National Institute for Petroleum and Energy Research] monthly progress report, February 1992.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Mar 1992. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92011498. Source: OSTI; NTIS; GPO Dep.

For this period, research is divided into Energy Production Research and Fuels Research. Energy Production Research includes reservoir characterization, microbial enhanced oil recovery, thermal EOR, alkaline flooding, gas flooding, flood process modelling, permeability and porosity research. Fuels Research included analysis of heavy crudes, and thermochemistry of organic nitrogen- and diheteroatom-containing compounds. The research of the Supplemental Government Program is also discussed.

17841 (OCS/MMS–91-0068) **Federal offshore statistics: 1990: Leasing, exploration, production and revenues.** Barbagallo, M.B.; Harris, W.M.; Heimberger, M.L.; O'Brien, D. (comps.). Minerals Management Service, Herndon, VA (United States). Office of Statistics and Information. [1991]. 99p. Sponsored by Department of the Interior, Washington, DC (United States). Source: OSTI; US Department of the Interior, Minerals Management Service, MS-4610, 381 Elden St., Herndon, VA 22070-4817.

The ninth edition of Federal Offshore Statistics reports the mineral leasing, exploration, and production activities on the submerged lands and seabeds of the Nation's Outer Continental Shelf, as of December 31, 1990. This edition also includes selected offshore statistics provided by the coastal states.

17842 **Method and apparatus for reducing the danger of vapour flash in oil, water and gas separators.** Jackston, T.P.; Jackson, N.D.; Olafson, J. 22 Sep 1991. Filed date 22 Mar 1990. Canada Patent patent application 2012782. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

In a method and apparatus for reducing the danger of vapor flash from separators used in oil fields, a secondary pressure vessel having an inlet, outlet, gas separation means, and gas venting means is placed inside a heated primary pressure vessel having an inlet, oil/water separation means, a water outlet, an oil outlet, and a means for venting gases. The outlet of the secondary vessel is connected to the inlet of the primary vessel. Oil well production flow containing gas along with an oil/water emulsion is passed through the secondary vessel at 10-60 lb pressure, thereby substantially degasifying the resulting oil/water emulsion which flows through the outlet of the secondary vessel into the inlet of the primary vessel. The oil and water are separated in the primary vessel at substantially atmospheric pressure, such that any gases remaining in the oil are released into the primary vessel for venting through the gas venting means to an external flare. It is recommended that about 4 ounces of pressure be maintained in the primary vessel to prevent air from entering the separator. Operating the primary vessel at near atmospheric pressure not only eliminates the danger of vapor flash, but also requires less heat to promote oil/water separation than operation at higher pressure. 1 fig.

0204 Processing

17843 (CMI-R–91/A30019) **A bilinear approach to the pooling problem.** Foulds, L.R. (Univ. of Waikato (New Zealand)); Joernsten, K.; Haugland, D. Christian Michelsens Inst. for Videnskap og Aandsfrihet, Bergen (Norway). Oct 1991. 25p. Order Number DE92506531. Source: OSTI; NTIS (US Sales Only).

The report presents an algorithm for the pooling problem in refinery optimization based on bilinear programming approach. The pooling problem occurs frequently in process optimization problems, especially refinery planning models. The problem is defined by formulating an aggregate mathematical model of a refinery, comment on solution methods for pooling problems that have been presented in the literature, and a new method based on convex approximation of the bilinear terms. 13 refs., 4 figs., 4 tabs.

17844 (CMI-R–91/A30020) **Optimization methods for blending models in oil refineries.** Haugland, D. Christian Michelsens Inst. for Videnskap og Aandsfrihet, Bergen (Norway). Nov 1991. 163p. Order Number DE92506530. Source: OSTI; NTIS (US Sales Only).

The report concerns a study of computational devices for optimal blending schedules in oil refineries. The main result presented is an algorithm which guarantees to locate a globally optimal solution to a nonlinear blending problem. A general model is established resembling frequently studied network models, and summarizes its basic mathematical properties. The optimization methods are studied in the light of this model, and a tree search method is proposed converging to the desired solution. Computational properties are investigated through numerical experiments. 123 refs., 33 figs., 4 tabs.

17845 Side-to-side FCC [fluid catalytic cracking] stripping apparatus with baffle-skirts having stripping gas injection ports. Cetinkaya, I.B.; Culler, R.P. To UOP (USA). 14 Nov 1991. Filed date 14 May 1990. Canada Patent patent application 2016727. 24p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

In fluid catalytic cracking (FCC), it is common to remove, or strip, occluded hydrocarbons from spent catalyst prior to passing catalyst into the regeneration zone. This is done to avoid excess carbon-burning load in the regenerator and to allow recovery of hydrocarbons as products. It has been found that good catalyst stripping can be achieved using conventional FCC stripping methods and devices with up to 50% or less of the stripping medium that was formerly used. These results are achieved by modifying the stripper grids according to this invention. In one embodiment, gas is used as stripping medium and the stripping apparatus includes a vertically oriented elongated vessel with a transverse cross-section open to catalyst flow that admits catalyst at the top and discharges catalyst at the bottom. Two or more grids located in the vessel provide a baffle system. The grids have a horizontally projecting surface for moving the catalyst from side to side as it travels down the vessel. Stripping gas added below the lowermost grid contacts the catalyst as it rises. Gas collection spaces formed by the underside of each grid and one or more sidewalls collect the upflowing stripping gas. The sidewalls include at least one skirt separating the gas collection space from the downward flowing catalyst. Each skirt contains 2 or more sets of gas injection ports arranged horizontally and sized to produce a gas jet that injects and distributes the stripping gas from the gas collection space into the downward flowing catalyst stream. Each set of ports has a different size opening to vary the injection jet length and distribute the gas over the entire width of the downward flowing catalyst stream. 8 figs.

0205 Products and By-Products

17846 Method for the preparation of methyl tertiary butyl ether. Smith, L.A., Jr. To Chemical Research and Licensing Co. (USA). 11 Oct 1991. Filed date 11 Apr 1990. Canada Patent patent application 2015574. 20p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method and apparatus are provided for conducting a catalytic distillation process which allows for maintaining a liquid level in selected portions of the catalyst bed. Three particular processes disclosed are the production of methyl tertiary butyl ether (MTBE), tertiary butyl alcohol, and cumene. A method for the production of MTBE by reaction of isobutene with methanol in a distillation reaction column is provided, in which a liquid level is maintained in the distillation reaction zone. Improving the contact of the liquid with the catalyst according to the invention increases the reaction rate. Experiences with commercial distillation units are described to illustrate the processes of the invention. 3 figs., 2 tabs.

17847 Hydrocarbon dehydrogenation catalyst. Bricker, J.C.; Jan, D.-Y.; Foresman, J.M. To UOP (USA). 29 Sep 1991. Filed date 29 Mar 1990. Canada Patent patent application 2013423. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Dehydrogenation of hydrocarbons is an important commercial process in the manufacture of such products as detergents, high-octane gasoline, oil additives, and plastics. An improved catalytic composite and process are provided for hydrocarbon dehydrogenation. The composite of the invention comprises a combination of a first Group VIII noble metal component, a second component selected from the group consisting of alkali or alkaline metal components or mixtures thereof, and a third component selected from the group consisting of Sn, Ge, Pb, In, Ga, Tl, or mixtures thereof with a theta-alumina support having a surface area of 120 m^2/g or less and a density of 0.5 g/cm^3 or more. In a preferred embodiment, the composite comprises a combination of catalytically effective amounts of Pt, Cs, and a third component as listed above, with a theta-alumina support having a surface area of 50-120 m^2/g and a density of 0.6 g/cm^3 or more. In the most preferred embodiment of the dehydrogenation process of the invention, the process occurs at 400-900°C temperature, 0.1-10 atm and a liquid hourly space velocity of 0.1-100/h. Experiments are described to illustrate aspects of the invention. 2 figs., 3 tabs.

0206 Health and Safety

17848 (NEI-NO--200) **Statistical description and estimation of ocean drift ice environments.** Korsnes, R. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Apr 1991 116p. Order Number DE92506526. Source: OSTI; NTIS (US Sales Only).

Part I of this thesis is on long-term iceberg collision-risk assessment methods for fixed offshore structures. Estimates for the long-term probability that an iceberg will hit a fixed offshore structure are based on estimates of the total volume of produced iceberg, a model for the size distribution of icebergs and a description of how iceberg trajectories "fill" the plane (the ocean's surface). Part II of the thesis discusses methods for analysis of low resolution data in the sense that the size of the area covered by each pixel is not small compared to the dominating floes. Still, this type of data can provide estimates of the ice extent (and hence the ice edge) and ice concentration. The estimates of the ice edge (at least) seem to be physically significant in the sense that "in some way" they can reflect ice drift in an image time sequence. A priori this is far from obvious. A central idea is that the "ice edge" is close to a transition zone between two different temperature regimes in the polar oceans. The estimates of the ice edges for the three Synthetic-Aperture Radar (SAR) mosaics provided for this thesis are plotted in the same figure and the movement seems to be continous and reflects ice drift. Part III of the thesis discusses quantitative (and automatic) methods for high resolution imagery data. Here, the size of the area covered by each pixel is small compared to the dominating floes. 46 refs. 47 figs., 2 tabs.

17849 (NEI-NO--209) **Accelerated testing and mechanical evaluation of components exposed to wear.** Onsoeyen, E. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Dec 1990 178p. Order Number DE92506546. Source: OSTI; NTIS (US Sales Only).

The topic of this thesis is reliability testing of mechanical components, in which wear is a dominant failure mechanism. As the time to failure is often much longer than the time available for testing, the test must be accelerated. An important part of the test preparation is the mechanical evaluation. The main motivation has been components operating under demanding conditions, and which may cause serious safety or economic consequences in the case of failure. An important group of such equipment are hydraulic components (valves, actuators and pumps) used in subsea petroleum production systems. The objectives of the work have been to: Describe the technological basis and problem area of accelerated testing of components exposed to wear; Contribute to further development of methods for accelerated testing and mechanical evaluation. The thesis is divided into two parts. Accelerated testing and mechanical evaluation of components exposed to wear - theoretical part; Case study - accelerated wear testing of hydraulic gear pumps. In addition, background knowledge is given in three appendixes, on the topics wear and lubrication, reliability of hydraulic equipment, and lifetime distributions. 59 refs., 46 figs., 2 tabs.

17850 (SV-UG--91-60) **Improvement of LPG-installations by experience feed-back and reliability methods.** Forsman, J. (Vattenfall Energisystem AB, Vaellingby (Sweden)). Vattenfall Utveckling AB, Vaellingby (Sweden). 16 Sep 1991. 36p. (In Swedish). Order Number DE92506566. Source: OSTI; NTIS (US Sales Only).

Basic facts on storage, usage and properties of LPG are summarized in this report. Swedish regulations pertaining to LPG-installations are briefly discussed. The basic design and main components of an industrial LPG-installation are described as well as suitable action in case of leakage or fire. Most accidents in LPG-installations are caused by defective equipment or human mistakes. An increased use of LPG in large scale installations calls for systematic reporting, analysis and feed-back of near-accidents in LPG installations. The goal of this is to improve safety and technology. A prerequisite is that events which can provide important information are reported. To ensure this it is believed that the legislation pertaining to LPG installations should require reporting of accidents and near-accidents as is the case for natural gas installations. Appropriate forms and instructions are needed to ensure that all important information is included in a report. The best results will probably be achieved if one organization gather, analyze and present information on reported events. The reliability engineering event tree technique is described and demonstrated as a method which can be used to analyze function and reliability of technicl systems like LPG-installations. Two failures or near-accidents in LPG fueled boiler installations are described in order to try to find out what happened and what experiences that can be learnt.

17851 (VTT-TIED–1305) **Assessment of the consequences of chemical spills.** Lautkaski, R. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Kukkonen, J.; Lamimaa, K. Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 149p. (In Finnish). Order Number DE92506490. Source: OSTI; NTIS (US Sales Only).

Physical phenomena associated with spills of liquid chemicals and liquefied gases are described. Mathematical models that can be used to analyze the consequences of spills are reviewed. The models can be used to estimate releases, source terms and atmospheric dispersion. For flammable chemicals, the effects of thermal radiation of an accidental fire and the pressure wave of an explosion can be modelled. The phenomena can affect people, property or the environment. Some design values of the vapour concentration of chemicals, thermal flux and overpressure are given to help to calculate hazard ranges. The migration of spills in pound or in watercourses is not discussed nor any accidents typical of solid chemicals e.g. dust explosions.

17852 (VTT-TUTK–696) **Extinguishment of liquid fires with sprinklers and water sprays: Analysis of the test results.** Kokkala, M. (Technical Research Centre of Finland, Espoo (Finland). Fire Technology Lab.). Technical Research Centre of Finland, Espoo (Finland). Aug 1990. 64p. Order Number DE92506491. Source: OSTI; NTIS (US Sales Only).

A series of extinguishing tests was carried out on ten liquids with a flash point in the range of 6 deg C to 234 deg C applying seven different sprinklers or nozzles. Pool size was varied within the range 0.4 m^2 - l2 m^2, and the nozzle height within the range 3 m - 8 m. In this publication the results of the tests are analyzed. Free burn data are considered in detail. Observations and effects of pool size, nozzle type, flash point, application rate, preburn time and nozzle height are discussed. Recommendations are made on the required application rates. A method of testing the applicability of sprinklers or nozzles against liquid pool or spill fires is proposed.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 17841, 18647, 18654, 18655

17853 (DOE/EI/22786–T1) **Residential home heating oil and propane survey, 1991–1992.** Maine State Planning Office, Augusta, ME (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC01-91EI22786. Order Number DE92013025. Source: OSTI; NTIS; GPO Dep.

This report contains pricing and consumption data on heating oils and propane for the Maine residential sector during the heating season 1991–1992. The information was gathered by survey. (VC)

17854 (DOE/EIA–0109(92/03)) **Petroleum supply monthly, March 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 30 Mar 1992. 159p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011454. Source: OSTI; NTIS; GPO; GPO Dep.

Data presented in the Petroleum Supply Monthly (PSM) describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in Primary Supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States.

17855 (DOE/EIA–0538(91/92-22)) **Winter fuels report, week ending February 28, 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 5 Mar 1992. 84p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012389. Source: OSTI; NTIS; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysis, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

17856 (DOE/EIA–0538(91/92-25)) **Winter fuels report, week ending March 20, 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 26 Mar 1992. 82p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012390. Source: OSTI; NTIS; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

17857 (IEE-SR–224) **Supply and demand of petroleum products in the Asian/Pacific rim region and a role of Japan's petroleum refining industry.** Institute of Energy Economics, Tokyo (Japan). 30 Sep 1991. 84p. (In Japanese). Order Number DE92514558. Source: OSTI; NTIS (US Sales Only).

This paper reports on the results of simulation using a Pacific Rim petroleum flow model. In the Pacific Rim region economic growth/social development have continued vigorus and are increasing oil demand. As for oil supply, however, it is predicted that crude oil production will reach the limit or be on the decrease on medium/long term bases in main oil producing countries in the region such as Indonesia, Australia, Malaysia, etc. Accordingly, to meet increasing oil demand, it is avoidable to depend on oil import from outside the region, which will cause a rapid increase in oil import from the Middle Eastern region which has a large amount of surplus oil production. Moreover, capacity increase of oil refining is planned in each country in the Pacific Rim region to cope with increasing oil demand to be forecast. However, the capacity increase plan cannot catch up with the increasing demand, and there is a possibility of a decrease in refining capacity in the whole region. 32 figs., 49 tabs.

17858 (WAOENG–91-01) **Implementation guide for the Washington State petroleum products contingency plan.** Washington State Energy Office, Olympia, WA (United States). Jan 1991. 24p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011820. Source: OSTI; NTIS.

This implementation guide explains how Washington will respond to a petroleum supply emergency and describes the roles various groups will play. This implementation guide first describes the State's four stages of a petroleum emergency. This is followed by a list of acronyms for organizations with critical roles to play. The organizations are referenced throughout the guide in the margin alongside tasks they may be requested or required to carry out. Your organization may be represented by more than one acronym, since come acronyms include groups of organizations. The final section describes emergency response actions, from which WSEO and the governor can choose. Not all actions will necessarily be implemented in an emergency.

17859 (WAOENG–91-07) **Washington State gasoline prices study: 1990 Biennial findings and technical appendices.** Anderson, M.; Lagerberg, B.; Byers, D. Washington State Energy Office, Olympia, WA (United States). Jul 1991. 163p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011824. Source: OSTI; NTIS.

In spring 1990, responding to strong public and private concern over gasoline supplies and pricing policies, the Washington Legislature commissioned the Washington State Energy Office (WSEO) to study this issue. The responsible committee-the Legislative Transportation Committee asked WSEO to clearly explain why gasoline prices differ from city to city in the state of Washington. This report summarizes the conclusions of a 1 year investigation. To support this investigation, WSEO collected data from 51 cities throughout the state of Washington, representing 750 gasoline stations, 10 refiners, and 131 gasoline wholesalers. To try to explain city-to-city and region-to-region differences, we collected information prices, volumes sold, suppliers, on-site convenience stores, cash discounts, whether a station was independently owned or oil company owned, and a host of other factors. About 150 factors were sought to assist in the analysis.

17860 (WSEO–91-384) **Washington State petroleum markets data book.** Lagerberg, B.; Anderson, M. Washington State Energy Office, Olympia, WA (United States). Jan 1992. 135p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011818. Source: OSTI; NTIS.

The Data Book is a resource for policymakers and analysis who work on energy issues. It is also for Washington citizens who are interested in knowing more about the role petroleum plays in Washington State. The Data Book is organized into four parts and four appendixes. Each part discusses a particular aspect of the petroleum market: supply (crude and refined products, refinery production, and distribution); consumption (by sector and by fuel); prices (crude and refined products, spot and transaction, wholesale and retail); and reliability of supply (stocks, reserves, emergencies, and the environment). Each part is followed by tables of supporting data. The appendixes contain related and supporting tables, a glossary of technical terms, and a list of the sources of data for each part of the book.

0208 Waste Management

17861 (PNL-SA–20173) **Thermal treatment of refinery wastes for oil recovery: The PST process.** Baker, E.G.; Elliott, D.C.; Sealock, L.J. Jr. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9112110–1: 3. annual symposium on environmental protection in energy industry, Tulsa, OK (United States), 12 Dec 1991). Order Number DE92010497. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) has been investigating thermal, high-pressure processing of organic waste streams. The range of research and development activities extends from fundamental studies of conversion of biomass, coal, and organic wastes in high-pressure aqueous environments to tests in small pilot-scale reactor systems. Several processes have been developed from these investigations including two that have already been licensed to private companies. The most recently developed process is the Petroleum Sludge Treatment (PST) system which separates and recovers oil and water from oil-in-water emulsions such as the US Environmental Protection Agency (EPA) "K" listed wastes. The PST process evolved from attempts to convert API and DAF sludges to methane gas using the Thermochemical Environmental Energy System process. We were unsuccessful in converting these sludges to methane, however it became evident that thermal, high-pressure processing was very effective in separating the components of these sludges. The concept was further investigated and refined and the PST process was granted a US Patent in 1990.

17862 **Variable weir assembly for drilling rig sump systems and method of use thereof.** Willis, H.C. 27 Dec 1991. Filed date 27 Jun 1990. Canada Patent patent application 2019947. 29p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A weir assembly is provided for closely controlling the elevation of the overflow level from one sump pit to another in a drilling mud management system. In a preferred form, the assembly has a vertically extending array of ports which may be individually opened or closed by hinged doors. The assembly is positioned in the ditch or conduit connecting a pair of settling pits and is used to control flow in the ditch or conduit. In the early stages of drilling, the overflow of the weir assembly is kept relatively low, so that settling can occur but only a small volume of fluid is retained in the first pit. As the level of solids rises in the first pit, the overflow level is adjusted upwardly in response. When the level of solids in the first pit begins to approach the desired maximum, solids deposition in the first pit can be substantially terminated by circulating clarified water through the first pit. By progressively raising the weir overflow level and preferably circulating additional water through the first pit, it is possible to jointly reduce the volume of liquid retained in the sump pits and to improve distribution of solids between the pits. The weir assembly is preferably formed in accordance with a configuration that is adapted to facilitate cementing it into the ground. The assembly can also be used as a component in a composite system comprising a conventional drilling rig closed mud system and a sump system. This composite system has been devised to enable the removal of ultrafines from the drilling mud while ensuring that the relatively small volume of the closed mud system is preserved. 8 figs.

0209 Environmental Aspects

Refer also to citation(s) 19444, 19560

17863 (DOE/EA–0601) **Environmental assessment of the interim lease of a warehouse for the Strategic Petroleum Reserve in Jefferson Parish, Louisiana.** USDOE Strategic Petroleum Reserve Project Management Office, New Orleans, LA (United States). Jan 1992. 5p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012189. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) strategic Petroleum Reserve (SPR) proposes to lease an existing commercial warehouse for the storage, maintenance, and periodic readiness testing of 15 trailer-mounted 2000-horsepower diesel engine-driven pumps. These pumps are spares for the seven SPR sites. The warehouse to be selected will be in or near Harahan, Jefferson Parish, Louisiana near the SPR Project Management Office and the offices of the SPR Management and Operating contractor. Environmental impacts of the storing and testing of the pumps are outlined.

17864 **Giant jem wing skimmer and separator for oil and other floating materials, liquids.** Meier, D.G. 15 Nov 1991. Filed date 14 May 1990. Canada Patent patent application 2025354. 23p. Source: Micromedia Ltd., Technical Information Centre, 165

Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A skimmer and separation process are provided for cleaning oil spills, in which both water and oil can be handled in large amounts. One version of the skimmer is designed for attachment to a ship and includes a floating winglike body for skimming oil comprising flotation tanks, a water passage for minimizing buildup of water in front of the skimmer, vacuum chambers and screens for receiving overflowing oil and water, vacuum pipes for oil and water transfer to a distribution tank, a deflector shield to keep oil and water in front of the skimmer, automatic control valves for flooding, emptying, and depth-setting of the skimmer, an operating platform and control center for observation and operation of the skimmer, a curved oilguiding plate to direct oil to the front of the skimmer, and a swivel attachment for providing free movement of the skimmer when attaching it to the ship's hull. A variant of this skimmer, without the oil-guiding plate and water passage, is provided for stationary operation in the case where oil must be skimmed from a water surface adjacent to a stationary leaking oil source. An associated overflow and separation system consists of pumps, transfer pipes, flotation vessels, separation equipment, and collector tanks. 13 figs.

0220 Transport, Handling, and Storage

Refer also to citation(s) 17832, 17850, 17863, 17874

17865 (CONF-911102–Vol.1) **Proceeding of the 4th international conference on stability and handling of liquid fuels: Volume 1.** Giles, H.N. (ed.). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of the Deputy Assistant Secretary for Strategic Petroleum Reserve. 1992. 478p. Sponsored by USDOE, Washington, DC (United States). From 4. international conference on stability and handling of liquid fuels; Orlando, FL (United States); 19-22 Nov 1991. Order Number DE92013168. Source: OSTI; NTIS; GPO Dep.

This Association provides an open forum for the exchange of ideas, information, and experience relative to refined petroleum products, crude oil, and fuels derived from shale, tar sands, and coal. The problems of instability, incompatibility, and contamination in liquid fuel storage and handling are discussed here. Specific topics outlined in Volume I are: Underground and Strategic Storage, Microbial Aspects of Petroleum Handling and Storage, Incompatibility, Thermal Stability of Aviation Turbine Fuels, Stability of Products other than Aviation Turbine Fuel, Handling Considerations in Fuel Instability.

17866 (CONF-911102–Vol.2) **Proceeding of the 4th international conference on stability and handling of liquid fuels: Volume 2.** Giles, H.N. (ed.). USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of the Deputy Assistant Secretary for Strategic Petroleum Reserve. 1992. 405p. Sponsored by USDOE, Washington, DC (United States). From 4. international conference on stability and handling of liquid fuels; Orlando, FL (United States); 19-22 Nov 1991. Order Number DE92013167. Source: OSTI; NTIS; GPO Dep.

The Association provides an open forum for the exchange of ideas, information, and experience relative to refined petroleum products, crude oil, and fuels derived from shale, tar sands, and coal. The problems of instability, incompatibility, and contamination with respect to liquid fuels storage and handling are discussed here. Specific topics included in Volume II are: Theoretical and Chemical Aspects of Fuel Instability, Assessment of Fuel Instability, Use of Additives in Controlling Fuel Instability. Poster presentations are also listed.

17867 (Y/SUB–91-TJ997C/12) **Site investigation report for underground storage tank 2331-U at Building 9201-1, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.** Bohrman, D.E. (Oak Ridge Y-12 Plant, TN (United States)); Ingram, E.M. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Dec 1991. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92011283. Source: OSTI; NTIS; INIS; GPO Dep.

This report represents the Site Investigation Report (SIR) for the Underground Storage Tank (UST) 2331-U located at Building 9201-1 of the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. This report documents results of investigations, conducted subsequent to the Initial Site Characterization, concerning petroleum releases from the UST, characterization of the release site, and delineation of soil and groundwater contamination required to evaluate and conduct remedial actions at the tank site. This report is written in accordance with regulatory requirements of the Tennessee Department of Environment and Conservation (TDEC) Rule 1200-1-15-.06, and of the United States Environmental Protection Agency (EPA) regulations promulgated under 40 CFR Part 280.

17868 (Y/SUB–91-TJ997C/13) **Site investigation report for underground storage tank 0134-U at Building 9204-2, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.** Bohrman, D.E. (Oak Ridge Y-12 Plant, TN (United States)); Ingram, E.M. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Dec 1991. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92011284. Source: OSTI; NTIS; INIS; GPO Dep.

This report represents the Site Investigation Report (SIR) for the Underground Storage Tank (UST) 0134-U located at Building 9204-2 of the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. This report documents results of investigations conducted subsequent to the Initial Site Characterization concerning petroleum releases from the UST, characterization of the release site, and delineation of soil and groundwater contamination required to evaluate and conduct remedial actions at the tank site. This report is written in accordance with regulatory requirements of the Tennessee Department of Environment and Conservation (TDEC) Rule 1200-1-15-.06 and with United States Environmental Protection Agency (EPA) regulations promulgated under 40 CFR Part 280. The principal contaminants expected in the vicinity of Tank 0134-U are unleaded gasoline and leaded gasoline (used prior to 1975). The probable source of these contaminants at the tank site is Tank 0134-U itself. Results of the Site Investigation soil sample analyses indicate that none of the sampled intervals exhibit benzene, toluene, and xylene (BTX) contamination in excess of the most stringent TDEC Closure Action Levels. Analyses of soil samples collected from the Tank 0134-U pit at the time of the tank removal in 1988 were also found to be below the most stringent closure levels for non-drinking water sources. However, results of the Site Investigation groundwater analyses for samples collected from the two site monitoring wells indicate that one of the wells (GW-204) contains benzene and total petroleum hydrocarbons (TPH) contamination in excess of TDEC Closure Action Levels for non-drinking water sources. Based on the Site Investigation analytical results, remediation of groundwater at the Tank 0134-U site is required.

17869 **Temporary disintegrated plug for an open-ended oil pipeline.** Savard, D.D. 27 Dec 1991. Filed date 27 Jun 1990. Canada Patent patent application 2019946. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method is provided for temporarily sealing the open-ended bore of a steel pipeline containing hydrocarbon vapors, so that welding and the like can be safely carried out at the pipe end. The seal consists of a plug formed of fibrous material held together with a wax binder in the form of a cylindrical body. The body is adapted to fit closely into the bore of the pipeline, and has a reduced-diameter inner end portion. A thick band of asphalt-base sealant is applied to the inner surface of the pipe at the location to be taken up by the reduced-diameter portion. The vertical inner end surface of the plug is also coated with the sealant. When the plug is inserted into the pipeline, its close fit holds it in place and the sealant seals across the bore. The plug disintegrates when contacted with the subsequent oil flow. The plug of the invention overcomes the disadvantages of known aquagel plugs. 2 figs.

17870 **Easy way pig puller.** Cinnamon, B. 7 Nov 1991. Filed date 7 May 1990. Canada Patent patent application 2016136. 5p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A manually operated tool is provided for pulling pigs from a horizontal pig receiver, commonly known in the oilfield as a pig trap. Known devices for pulling pigs from the receiver with a hook have the disadvantage that when they are used, the hook tends to slip over, under, or around the pig being pulled. These disadvantages may be overcome by using a shaft connected to a paddle on one end and an activating handle on the other. In use, the device of the invention is inserted into the pig trap with the paddle in the horizontal position. Once inserted at the end of the pig receiver barrel, the handle is activated, causing a wire attached to the handle and running through the shaft to move the paddle to a vertical position. The paddle is held in this position in order to retrieve all the pigs in the receiver. 3 figs.

17871 Fuel line adapter for portable fuel containers. Malamas, S.; Malamas, D. 2 Nov 1991. Filed date 2 May 1990. Canada Patent patent application 2015887. 7p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A safe means is provided for supplying gasoline or other liquid petroleum fuels from a portable fuel container, such as a jerry can, to an internal combustion engine. The preferred embodiment of the invention comprises a disc-shaped adapter of appropriate diameter and design to replace existing caps or sealing discs. The adapter also comprises a length of tubing or hose extending to the bottom of the fuel can and to one integrally affixed or molded component of a quick-disconnect fuel line coupling device. A preferred application of the adapter is for use in small outboard engine powered boats, so as to prevent or avoid fuel spillage when refilling the fuel supply tank. The coupling and fuel line adapter assembly of the invention may be left in place in lieu of the commonly used spout sealing disc normally supplied with the portable fuel container, since it self-seals when uncoupled from the fuel line distally connected to the engine. 3 figs.

17872 Upgrading oil emulsions with carbon monoxide or synthesis gas. Bruijn, T.J.W.; Woods, J.H. 13 Sep 1991. Filed date 13 Mar 1990. Canada Patent patent application 2012071. 43p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Variations of a novel procedure are disclosed for reducing the viscosity and density of heavy oils to make them amenable to transport by pipeline from the field to refineries for further processing. The procedure involves contacting a water emulsion of a heavy oil with carbon monoxide at a pressure and temperature range such that a water gas shift reaction takes place to convert the steam and carbon monoxide to hydrogen and carbon dioxide. Simultaneously, a thermal rearrangement occurs, thereby reducing the viscosity and density of the oil without any significant thermal cracking. Under one scheme carried out below 400°C, there is substantially no cracking and minimal molecular changes. At a temperature range up to 460°C, significant cracking and molecular changes take place. Nevertheless, under both schemes there is a net production of hydrogen and carbon dioxide, and both may be separated and used in other processes. The processes of the invention are illustrated by experiments on various western Canadian heavy oil emulsions. 10 figs., 8 tabs.

17873 Fuel oil compositions. Sexton, M.D.; Strange, R.H. 6 Sep 1991. Filed date 6 Mar 1990. Canada Patent patent application 2011557. 29p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

When diesel and heating oils containing cracked components are stored at ambient or elevated temperatures in air, they become discolored and precipitate sludge or sediment. It is clear that the problem of discoloration and sediment formation is exacerbated by the presence of cracked components in the fuel. It has been found that sediment and color formation in distillate fuels stored at ambient temperatures for long periods can be reduced by the addition of certain quaternary ammonium compounds. Accordingly, a fuel composition is provided comprising a fuel oil obtained by the cracking of heavy oil and a quaternary ammonium compound which is soluble in the fuel. The quaternary ammonium compoundd comprises a hydrocarbyl cation in which the ratio of carbon atoms to quaternary nitrogen atoms is not more than 10:1 and an anion which is derived from an acid which is a carboxylic acid, carboxylic acid anhydride, a phenol, a sulfurized phenol, or a sulfonic acid. The hydrocarbyl group or groups optionally carry a tertiary amino nitrogen atom or atoms, but are otherwise unsubstituted. The fuel oil compositions of the invention may also contain other additives such as antioxidants, fluidity improvers, detergents, and cetane improvers in amounts usually less than 2 wt %. Examples of fuel oil compositions of the invention are given to illustrate the performance of the additive in reducing sedimentation and discoloration. 4 tabs.

0230 Properties and Composition

Refer also to citation(s) 17840, 18990

17874 (DOE/FE–0245) **Strategic petroleum reserve crude oil assays.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Strategic Petroleum Reserve. Nov 1991. 23p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012433. Source: OSTI; NTIS; GPO Dep.

This booklet provides background information on the purchase of crude oils for the Strategic Petroleum Reserve (SPR), procedures used to assess quality of the stored petroleum, and methods used in generating assays of the various streams which may be sold. Current assays of the eight SPR crude oil streams are included.

17875 (SAND–91-8721) **High-temperature ignition of propane with MTBE as an additive: Shock-tube experiments and modeling.** Gray, J.A. (Sandia National Labs., Livermore, CA (United States)); Westbrook, C.K. Sandia National Labs., Livermore, CA (United States). [1991]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789 ;W-7405-ENG-48. (CONF-920707–9: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006679. Source: OSTI; NTIS; GPO Dep.

Ignition of propane has been studied in a shock tube and by computational modeling to determine the effect of methyl tert-butyl ether (MTBE) as a fuel additive. MTBE and isobutene were added in amounts up to 25% of the fuel to propane-oxygen-argon mixtures in shock-tube experiments covering a range of temperatures between 1450 and 1800 K. Ignition delays were measured from chemiluminescence at 432 nm due to excited CH radicals. The temperature dependence of the ignition rates was analyzed to yield Arrhenius parameters of $E_a \sim 40$ kcal/mol and log (A)~ 9.0 sec^{-1} for the overall reaction. Reactions involving MTBE and its decomposition products were combined with an established propane mechanism in a numerical model to describe the kinetic interaction of this additive with a typical hydrocarbon fuel. The experiments and the kinetic model both show that MTBE and isobutene retard propane ignition with nearly equal efficiency. The kinetic model demonstrates that isobutene kinetics are responsible for inhibition by both MTBE and isobutene, and the specific elementary reactions which produce this behavior are identified.

0250 Combustion

Refer also to citation(s) 19063, 19073, 19075

17876 (ENET–9100283/1) **Low pollutant combustion of heavy heating oil: Final report.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Jan 1991. 16p. (In German). NEFF-Projekt Nr. 470. Order Number DE92515354. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

This report contains the results of tests using the 8 tons steam boiler with OERTLI OECONOX system heavy oil firing technology in the Netstal paper factory. In addition to the complete combustion of heavy heating oil this project also involved the reduction of pollutant emissions. This report presents the new firing technology and discusses the results of nitrogen, CO and solids reduction.

Process concepts for the combustion of general heavy fuels can then be derived from the results. figs., tabs.

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

17877 (DOE/METC/C–92/7011) **Detection development needs for gas hydrates in sediments.** Malone, R.D. (USDOE Morgantown Energy Technology Center, WV (United States)); Dillon, W. USDOE Morgantown Energy Technology Center, WV (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). (CONF-920653–1: 2. international offshore and polar engineering conference, San Francisco, CA (United States), 14-19 Jun 1992). Order Number DE92010528. Source: OSTI; NTIS; GPO Dep.

Water and natural gas, under certain conditions of temperature and pressure, can form naturally occurring gas hydrates in sediments that underlie ocean basins and permafrost regions. Hydrates have been identified in the offshore environment during drilling and coring of certain formations. However, normal sampling of seafloor sediments has not always revealed their presence, because they invert to free gas and dissipate during transport to the surface. Geophysical and geochemical techniques may provide the answer to the detection of hydrates in ocean sediments and allow a more detailed determination of the volume of hydrates within the sediments. While there has been research directed toward the understanding of both surface and subsurface geophysical techniques and their relationship with gas hydrate formations, the work is in preliminary stages of understanding and development. This paper will attempt to summarize the problems related to the detection of gas hydrates; identify some promising research in both geophysical and geochemical methods which may provide better, more reliable detection techniques for identifying gas hydrate deposits; and attempt to indicate the areas where more research is needed.

0303 Drilling, Production, and Processing

Refer also to citation(s) 17836, 17880

0305 Health and Safety

Refer also to citation(s) 17851

17878 (VTT-PUB–84) **The quantitative risk assessment (QRA) of major toxic hazards.** Kakko, R. (Technical Research Centre of Finland, Espoo (Finland). Safety Engineering Lab.). Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 194p. Order Number DE92506503. Source: OSTI; NTIS (US Sales Only).

The procedure used in a quantitative top-down consequence and risk assessment is described and evaluated. Two example cases of practical application of a quantitative consequence and risk assessment are introduced. These studies have been made in the feasibility or preliminary design stage of a new installation. Both cases concern the storage of liquefied natural gas (LNG).

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 17855, 17856, 18655

17879 (DOE/EIA–0130(92/03)) **Natural gas monthly, March 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 30 Mar 1992. 155p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011455. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

17880 (DOE/FE–0251P) **Natural gas strategic plan and multi-year program crosscut plan, FY 1993–1998: Draft working document.** USDOE, Washington, DC (United States). Apr 1992. 231p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012383. Source: OSTI; NTIS; INIS; GPO Dep.

The overall mission of the Natural Gas Program is to enhance the Nation's energy security, environmental quality, and economic strength by displacing oil use in the US and increasing efficient use of natural gas. In support of this are programs that will improve the confidence in the continued availability of a long term gas supply (Resource and Extraction Area); provide more cost-effective and competitive means to use natural gas (Utilization Area); develop improved and less costly means of delivering and storing natural gas (Delivery and Storage Area); and to minimize barriers to efficient market operation, promote cost-effective regulation based on improved environmental assessments, and to assure availability to industry of low-cost waste management and waste minimization technology (Environmental/Regulatory Impact Area). (VC)

17881 (NEI-NO–203) **Some economic aspects of the European natural gas market.** Golombek, R. Oslo Univ. (Norway). Sosialoekonomisk Inst. 1990 156p. (In English, Norwegian). Order Number DE92506529. Source: OSTI; NTIS (US Sales Only); INIS.

The thesis consists of five papers with following titles: Optimal utilization of natural gas. Computation of the resource rent for Norwegian natural gas; The relationship between the price of natural gas and crude oil - some aspects of efficient contracts; Bargaining and international trade - the case of Norwegian natural gas; On bilateral monopoly - a Nash-Wicksell Approach; Bertrand games and duopoly.

0307 Waste Management

Refer also to citation(s) 17862

0308 Environmental Aspects

Refer also to citation(s) 17802, 17880

0320 Transport, Handling, and Storage

Refer also to citation(s) 17865, 17866, 17879

0340 Combustion

Refer also to citation(s) 17880, 18703, 18717, 18790, 19059, 19076

17882 (NEI-DK–784) **Physical modelling of torch fires: An experimental study of large natures gas flames. Final report.** Ott, S. Risoe National Lab., Roskilde (Denmark). Systems Analysis. [1991] 42p. Contract EV4T-0027-DK(B). Order Number DE92506313. Source: OSTI; NTIS (US Sales Only).

Cover title: An experimental study of large natural gas flames.

A natural gas flame test facility has been built at Risoe. Horizontal flames of length up to 8-10 meter (outflow 0.13 kg/s) can be produced. Two series of experiments have been conducted. In the first series free flames extending downwind were studied, and measurements included: temperature profiles in the flame, heat radiation to the surroundings and infrared thermography as well as background meteorology and outflow conditions. In the second series of experiments the net heat transfer to a cylindrical object placed vertically in the hottest part of the flame was measured using the (steel) cylinder as a calorimeter. The heat transfer was found to be largest on the front side facing the burner (up to 100 kW/m^2) and 2 to 3 times smaller on the back side. A database containing all measurements is abailable from Risoe. (author).

17883 (NEI-DK–808) **Inlet regulation of gas blast burners at varying operational conditions.** Teknisk Note, 2/1991. Rasmussen, N.B. Dansk Gasteknisk Center A/S, Hoersholm (Denmark). Oct 1991 77p. (In Danish). Order Number DE92506341. Source: OSTI; NTIS (US Sales Only).

The control and regulation of gas-fired systems of varied sizes is dealt with. The influence of weather and other conditions on the immediate quality of combustion is explained and suggestions are given for the construction of gas-fired systems, in addition to information on Danish regulations in this respect. Regarding safety, it is suggested that either the allowed variations of Wobbe number and the gas pressure should be adjusted to the individual case or the inlet control and the system should be adjusted in accordance to the allowed variations. It is also concluded that in relation to control of inlet the immediate weather and other conditions that influence combustion quality must be taken into consideration. Methods of adjustment are presented. In this way the systems can be optimized so that the risk of carbon monoxide production is minimal, and energy is saved. (AB).

17884 (WAOENG–91-15) **Alternative fuels for Washington's school buses: A report to the Washington State Legislature.** Lyons, J.K.; McCoy, G.A. Washington State Energy Office, Olympia, WA (United States). Dec 1991. 66p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011827. Source: OSTI; NTIS.

This report discusses air quality improvement actions by regulators – both at the state and federal levels – and summarizes vehicle design, development,and commercialization activities by all major engine, automotive, and school bus manufacturers. The report also examines Washington's school bus fleet and recommends actions that can be taken to ensure that the emissions reduction benefits from purchasing and operating clean-burning vehicles can be captured. (VC)

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

17885 (DOE/MC/26268–3039) **The extraction of bitumen from western tar sands: Annual report.** Oblad, A.G.; Bunger, J.W.; Deo, M.D.; Hanson, F.V.; Miller, J.D.; Seader, J.D. Utah Univ., Salt Lake City, UT (United States). Jul 1990. 431p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26268. Order Number DE92001113. Source: OSTI; NTIS; GPO Dep.

Topics discussed include: characterization of bitumen impregnated sandstone, water based tar sand separation technology, electrophoretic characterization of bitumen and fine mineral particles, bitumen and tar sand slurry viscosity, the hot water digestion-flotation process, electric field use on breaking water-in-oil emulsions, upgrading of bitumens and bitumen-derived liquids, solvent extraction.

0403 Drilling, Fracturing, and Mining

17886 (DOE/MC/11076–3072) **An evaluation of some innovative fragmentation systems for oil shale.** Hieta, M. (Western Research Inst., Laramie, WY (United States)); Hustrulid, W.A. Western Research Inst., Laramie, WY (United States); Colorado School of Mines, Golden, CO (United States). Jun 1991. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE92001257. Source: OSTI; NTIS; GPO Dep.

This report describes a large-scale underground mining method, large-hole stoping, using some innovative fragmentation systems (buffer blasting, continuous loading/hauling, and mechanical miners for development). This study includes a literature review and an experimental study of one of the key design factors–buffer blasting. The purpose of the buffer-blasting experiments is to examine the swell that is necessary to achieve satisfactory fragmentation results. The study also includes a technical and economic evaluation of the new mining method compared with conventional room and pillar mining. The purpose of this study is to examine innovative methods that exist today and may provide a more efficient mining system than that currently used. Note that this is a conceptual study, and that the mining for the two mine designs were compared using a daily production rate of 75,000 tones per day. This amount was chosen because it is the maximum amount possible for a rubber-tired room and pillar operation with only a one-shaft complex.

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 17885, 17890, 18656

17887 (DOE/MC/26268–92/C0012) **Hydrotreating the bitumen-derived hydrocarbon liquid produced in a fluidized-bed pyrolysis reactor.** Longstaff, D.C.; Deo, M.D.; Hanson, F.V.; Oblad, A.G.; Tsai, C.H. Utah Univ., Salt Lake City, UT (United States). Dept. of Fuels Engineering. [1991]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26268. (CONF-911182–11: Eastern oil shale symposium, oil shale, tar sands, heavy oil, Lexington, KY (United States), 13-15 Nov 1991). Order Number DE92012545. Source: OSTI; NTIS; GPO Dep.

The pyrolysis of bitumen-impregnated sandstone produces three primary product streams: C_1-C_4 hydrocarbons gases, a C_5^+ total liquid product, and a carbonaceous residue on the spent sand. The bitumen-derived hydrocarbon liquid was significantly upgraded relative to the native bitumen: it had a higher API gravity, lower Conradson carbon residue, asphaltene content, pour point and viscosity and a reduced distillation endpoint relative to the native bitumen. The elemental composition was little different from that of the native bitumen except for the hydrogen content which was lower. The bitumen-derived liquid produced in a 4-inch diameter fluidized-bed reactor from the Whiterocks tar sand deposit has been hydrotreated in a fixed-bed reactor to determine the extent of upgrading as a function of process operating variables. The extent of denitrogenation and desulfurization of the bitumen-derived liquid was used to monitor catalyst activity as a function of process operating variables and to estimate the extent of catalyst deactivation as a function of time on-stream. The apparent kinetics for the nitrogen and sulfur removal reactions were determined. Product distribution and yield data were also obtained.

17888 **Low temperature version of the hot water extraction process for oil sand.** Cymbalisty, L.M.O.; Stone, J.A.; Siy, R.D. 31 Oct 1991. Filed date 30 Apr 1990. Canada Patent patent application 2015785. 20p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A novel combination of conditions has been discovered which, when applied to the conventional hot-water process, causes the so-modified process to produce a comparable yield of primary bitumen froth with less heat consumption. The conditions involved relate to the conditioning step. The conditioning step is conducted without the addition of steam and sufficient hot process water is added to the tumbler to supply all the heat required to yield an oil sand slurry having a temperature in the 40-55°C range. The retention time of the slurry in the tumbler is increased to 7-12 minutes. Preferably, the amount of hot process water (typically 70-95°C) added in the conditioning step is in the range of ca 25-35 wt % of the oil sand and the amount added, including the flooding step, is in the range of ca 45-65%. The resulting process eliminates the capital and operating costs associated with using steam. While the process of the invention uses more mechanical energy than the conventional process, its cost is less than the use of heat needed to operate at 80°C. It has been surprisingly found that the separation of bitumen is more responsive to mechanical energy than to thermal energy; 0.45 kJ of mechanical energy has been found to have the same effect as 61 kJ of thermal energy. Examples of pilot plant tests are described to illustrate the performance of the process of the invention. 1 fig., 3 tabs.

17889 **In situ tar sands reduced pressure separation process and apparatus.** Broughton, A.R.I. 5 Oct 1991. Filed date 5 Apr 1990. Canada Patent patent application 2013987. 19p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method is provided for separating bitumen from tar sands in-situ. A sealed cavity is formed in a body of in-situ raw tar sand, such as by drilling a hole or otherwise excavating a cavity by known methods. A liquid such as water is added to the cavity, the cavity is sealingly closed and subjected to a negative pressure (less than ambient) for a sufficient period of time to allow sand, in the raw material in the cavity and in contact with the liquid, to separate from the bitumen and settle to the bottom. Separation takes place on the walls of the cavity and with the bitumen-containing sand in its natural location. During this time, the bitumen floats to the top of the liquid, from which it is removed by pumping or other convenient methods. The negative pressure can be varied cyclically and/or the liquid can be mechanically agitated. Carrying out the process in-situ has a number of advantages including low power requirements, ability to exploit tar sand deposits currently considered uneconomical or inaccessible, and no waste products that require disposal. 1 fig.

0409 Waste Management

17890 (DOE/MC/11089–92/C0007) **Activated sludge studies of selected contaminents of PFH wastewater.** Dudley, S.K. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Bustamante, R.B.; Bonner, W.P. Institute of Gas Technology, Chicago, IL (United States); Tennessee Technological Univ., Cookeville, TN (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC11089. (CONF-911182–4: Eastern oil shale symposium, oil shale, tar sands, heavy oil, Lexington, KY (United States), 13-15 Nov 1991). Order Number DE92011200. Source: OSTI; NTIS; GPO Dep.

Acetone, propionitrile, pyrrole, and thiocyanate were selected as representative compounds of wastewater expected from pressurized, fluidized-bed hydroretorting (PFH) of Eastern oil shales. The PFH process has been the subject of investigation by the Institute of Gas Technology, under contract with the United States Department of Energy, for the purpose of obtaining higher oil yields from Eastern shales than has been possible using conventional retorting methods. Preliminary batch experiments illustrated that acetone, propionitrile, pyrrole, and thiocyanate are aerobically biodegradable by heterogeneous microbiological cultures. Three continuous flow activated sludge reactors were used to further evaluate the biological treatability of the synthetic waste. The studies revealed that the compounds could be removed at hydraulic residence times of as low as one day. Three one-day experiments demonstrated that biological system's capability to accept organic shock loadings without a change in effluent quality. A no-recycle reactor illustrated that the flocculent microbiological population had a high resistance to solids washout. Because a supplementary nitrogen source was not included in synthetic waste treated by the no-recycle unit, it was shown that propionitrile, pyrrole, and/or thiocyanate supplied the nitrogen necessary for biological activity.

17891 **Volatile liquid recovery process.** Govier, G.W. 20 Sep 1991. Filed date 20 Mar 1990. Canada Patent patent application 2012563. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A process is provided for recovery of a water-immiscible volatile liquid from a feed mixture of granular solids containing water and the volatile liquid. The feed mixture is introduced into a rotating preheat tube to form a bed within the tube that is advanced axially. The preheat tube is heated externally to raise the temperature of the bed to ca 95-100°C in the course of passing through the tube. The heated feed mixture is advanced through an insulated stripping tube and a stream of steam is flowed countercurrently through the stripping tube. The steam stream is adapted to maintain the temperature of the bed at ca 95-100°C as it passes through the stripping tube. Substantially all of the volatile liquid is vaporized in the course of passing through the tubes and the steam suppresses vaporization of water from the bed in the stripping tube. The vapors produced in this process are then recovered. The process of the invention has been especially intended to recover hydrocarbon solvents (commonly naphtha) from oil sand agglomerates produced during solvent extraction of bitumen from oil sand. 2 figs.

0430 Transport, Handling, and Storage

Refer also to citation(s) 17865, 17866

05 NUCLEAR FUELS

0504 Feed Processing

17892 (BARC–1991/P/002) **Fuel Chemistry Division: annual progress report for 1988.** Vaidyanathan, S. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Fuel Chemistry Div.). Bhabha Atomic Research Centre, Bombay (India). 1991. 158p. Order Number DE92625522. Source: OSTI; NTIS (US Sales Only); INIS.

The progress report gives the brief descriptions of various activites of the Fuel Chemistry Division of Bhabha Atomic Research Centre, Bombay for the year 1988. The descriptions of activities are arranged under the headings: Fuel Development Chemistry of Actinides, Quality Control of Fuel, and Studies related to Nuclear Material Accounting. At the end of report, a list of publications published in journals and papers presented at various conferences/symposia during 1988 is given. (author). 13 figs., 61 tabs.

17893 (DOE/EH–0228) **Environment, safety and health progress assessment of the Fernald Environmental Management Project (FEMP).** USDOE, Washington, DC (United States). Nov 1991. 204p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012437. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the results of the Environment, Safety, and Health (ES&H) Progress Assessment of the Fernald Environmental Management Project (FEMP), Fernald, Ohio, conducted from October 15 through October 25, 1991. The Secretary of Energy directed that small, focused, ES&H Progress Assessments be performed as part of the continuing effort to institutionalize line management accountability and the self-assessment process in the areas of ES&H. The FEMP assessment is the pilot assessment for this new program. The objectives for the FEMP ES&H Progress Assessment were to assess: (1) how the FEMP has progressed since the 1989 Tiger Assessment; (2) how effectively the FEMP has corrected specific deficiencies and associated root causes identified by that team; and (3) whether the current organization, resources, and systems are sufficient to proactively manage ES&H issues.

17894 (INIS-mf–13146) **A prototype study with solvent extraction on industrial scale.** Hernandez, M.E. Instituto Tecnologico, Toluca (Mexico). 1990 163p. (In Spanish). Order Number DE92625523. Source: OSTI; NTIS (US Sales Only); INIS.

The need for uranium purification has generated the study of different methods in order for purification to be achieved, having had excellent results in the laboratory with ionic exchange methods, extraction by means of solvents and chromatography. Pilot experiments of the ionic exchange method have been performed, using as experimentation equipment the columns of ionic exchange, attaining some results without concreting the objectives. Likewise several experiments in mixer-settlers have been performed for the purification of uranium by the solvent extraction method, where there were serious problems with the formation of a third incontrollable phase, and also, due to the later, low purification of the uranium when distributing from one phase to the other. Knowing these problems brought on by the performed experiments in mixer-setters by groups of researchers interested in this part of the nuclear fuel, the task of designing a prototype of extraction with solvents of the mixer-settler type was undertaken in the project 'Models and simulation of equipment and processes of the refinement and conversion department'. The purification of uranium as uranyl nitrate [$UO_2(NO_3)_2$] was developed, establishing the conditions for the equipment operation, concluding that, with some relatively simple adjustements, it is possible to apply in different areas, taking note of the specific needs of mining, cosmetics, perfume and pharmaceutical areas. (Author).

17895 (NBL–325) **A contained sealed reflux dissolution apparatus for plutonium materials.** Oldham, R.D.; Mitchell, W.G.; Leahy, C.K.; Narayanan, U.I.; Lewis, K. USDOE New Brunswick Lab., Argonne, IL (United States). Dec 1991. 91p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013024. Source: OSTI; NTIS; GPO Dep.

A containment apparatus has been designed and a procedure developed which permits the overnight operation in a tornado prone area of the sealed reflux dissolution system for the dissolution of hard-to-dissolve plutonium containing materials. A historical review of the development of the apparatus and the procedure used at the New Brunswick Laboratory is presented. The detailed operating procedure, the engineering drawings necessary to fabricate the apparatus, and the Safety Analysis Report containing a worst-case, single occurrence failure analysis are provided in the Appendices. 3 refs.

0507 Fuels Production and Properties

Refer also to citation(s) 18895, 18938

17896 (DPST–83-276) **Preparation and physical properties of U_3O_8.** Peacock, H.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 31 Jan 1983. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011120. Source: OSTI; NTIS; GPO Dep.

Uranyl nitrate solution from 200-Area processing of spent SRP fuel tubes is now sent to Oak Ridge Y-12 for conversion of uranium metal. However, after implementation of the powder metallurgy (P/M) process, U_3O_8 powder will be needed at SRP but not uranium metal. U_3O_8 powder for fabrication and irradiation tests was produced during development of P/M at SRL by firing UO_3, obtained from Y-12, at 800°C for 6 hours in a low grade nitrogen atmosphere. The UO_3 powder was produced by denitration of unsulfated uranyl nitrate solution. The stoichiometry, particle size distribution, surface area and density of the Y-12 and SRL powders were measured. A comparison was then made between SRL U_3O_8 produced at 800°C in nitrogen and in air and U_3O_8 produced at Y-12 at other heating temperatures.

17897 (INIS-SU–309/A, pp. 83-89) **Study of mixed uranium-plutonium oxide fuel behaviour under irradiation.** Reshetnikov, F.G. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Golovin, I.S.; Men'shikova, T.S.; Rodin, V.M.; Filatkina, V.P.; Ivanov, Yu.A.; Zelenskij, K.G.; Moseev, L.I.; Kuz'min, V.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The serviceability of the mixed pellet fuel elements of experimental assemblies was tested in a series of BOR-60 and BN-350 reactor tests. The burn-up in the BOR-60 reactor was up to 12% h.A. At the heat density of 450-560 w/cm, the testing temperature is 670-740 deg C, the damaging dose is 63 dpa for cold worked steel. It is established that 0.15-1.54% mass. americium-241 contained by the initial fuel neither influenced its irradiation behaviour nor affected its serviceability. The first series of tests was concuted in BN-350 using a large number of fuels. 1270 fuel rods were tested at the heat generation rate of 495 w/cm. In the next series of tests the burn-up reached by the experimental assemblies was 9% h.A. At the fluence of 1.3×10^{23} n/cm^2. 4 refs.; 6 figs.; 1 tab.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 17921, 18110, 19046, 19053, 19058, 19083

17898 (HAN–26626) **234-5 status reports.** Lowe, W.W. Hanford Works, Richland, WA (United States). 14 Jul 1949. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011858. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On July 14, 1949, and office memorandum was written about operations of a reprocessing building on the Hanford Site being suspended due to the mishandling of some plutonium powder. The letter describes the process of decontamination of the building surfaces, and the ventilation of the rooms of that building. It also describes the problem with the ventilation fans due to increased temperature and pressures.

17899 (HW–17986-RD) **Exhibits used in chemical development section seminar on deentrainment.** Merrill, E.T.; Figg, W.S. Hanford Works, Richland, WA (United States). 20 Jun 1950. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011862. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report consists of graphs and charts exhibited at the Chemical Development Section Deentrainment Seminar on June 2, 1950.

17900 (HW–29230) **Radiological Sciences Department investigation radiation incident, Class I, No. 299.** Ebright, D.P. Hanford Works, Richland, WA (United States). 25 Aug 1953. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011864. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Fragments of radioactive materials were deposited in the Redox area during August, 1953. By radiation monitoring, the location, physical properties, and dosage were determined. The cause was assumed to be the buildup of ammonium nitrate containing ruthenium on the filters of the Redox stack. The amount of occupational exposure, and the reasons why this incident happened were also discussed.

17901 (INIS-SU–305/A, pp. 224) **Effect of association process in organic phase on actinoid extraction in uranium systems.** Fedorov, Yu.S. (Radievyj Inst., Leningrad (USSR)); Zil'berman, B.Ya.; Korolev, V.V.; Afonin, M.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NEPTUNIUM NITRATES/solvent extraction; THORIUM NITRATES/solvent extraction; URANYL NITRATES/solvent extraction; CHEMICAL REACTION KINETICS; DISTRIBUTION FUNCTIONS; DODECANE; FREQUENCY DEPENDENCE; PERMITTIVITY; SOLVATION; TBP

17902 (INIS-SU–305/A, pp. 225) **Isoparaffin diluents in extraction technology of fissile materials regeneration for improvement of technological reliability and nuclear safety of process.** Chizhov, A.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Neumoev, N.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ALKANES/solvents; PLUTONIUM COMPLEXES/solvent extraction; REPROCESSING/reliability; REPROCESSING/solvents; THORIUM COMPLEXES/solvent extraction; ALKANES; SOLVENTS; DENSITY; ISOMERS; MELTING POINTS; PHOSPHORIC ACID ESTERS; RADIATION PROTECTION; REPROCESSING; RELIABILITY; STABILITY; VISCOSITY

17903 (INIS-SU–305/A, pp. 260) **On optimization of pulse column cascade in process of extraction repurification of uranium regenerates.** Bykov, E.D. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Litvinenko, V.G.; Sharavara, N.A.; Popkov, A.A.; Bykov, V.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. EXTRACTION COLUMNS/optimization; URANIUM COMPLEXES/solvent extraction; OPTIMIZATION; MATHEMATICAL MODELS; PURIFICATION; REPROCESSING

0509 Transport, Handling, and Storage

Refer also to citation(s) 17931, 19080, 19085, 19086, 19092, 20597

17904 (AECL–10476) **Microstructures and phase relationships of crystalline oxidation products formed on unused CANDU fuel exposed to aerated steam and aerated water near 200 degrees C.** Taylor, P.; Wood, D.D.; Owen, D.G.; Hutchings, W.G.; Duclos, A.M. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment; Ontario Hydro, Toronto, ON (Canada). Nov 1991. 77p. (COG–91-292.). Order Number DE92626801. Source: OSTI; NTIS (US Sales Only); INIS.

This report reviews the findings from dry-, moist- and wet-air oxidation experiments on unused UO_2 fuel specimens at 200-225 degrees C, performed in support of the Dry Storage Program for used CANDU (CANada Deuterium Uranium) fuel. The presence of liquid water, or unsaturated steam, adds to the complexity of air oxidation of UO_2. The following processes have been identified by using a combination of optical and scanning electron microscopy and X-ray diffraction to detect oxidation products, and are discussed in this report: oxidative dissolution of U(VI) and precipitation of hydrated UO_3; back-reduction of dissolved U(VI) and precipitation of U_3O_8 on the UO_2/U_3O_7 surface; solid-state surface and grain-boundary oxidation of UO_2 to β-U_3O_7; and, preferential dissolution of UO_2 grain boundaries. Although moisture thus adds greatly to the variety of oxidation reactions that can occur on UO_2 surfaces, it does not appear to promote swelling and spalling of the fuel, in spite of the large increase in molar volume associated with formation of the hydrated phase. This conclusion is qualified, however, since variability in the reactivity of fuel specimens, particularly with respect to grain-boundary oxidation, makes it difficult to distinguish moisture effects. With unused fuel, grain-boundary alteration to U_3O_7 is the primary process by which oxidation penetrates the fuel near 200 degrees C. Reactions involving water proceed on the specimen surface, and can also follow oxidized grain boundaries and open porosity. Because of differences in the pore and grain-boundary structure of unused and used UO_2 fuel, as well as possible radiolytic processes in the latter, comparisons between these findings and the results of the ongoing CEX-1 (dry controlled-environment experiment) and CEX-2 (moist) used-fuel storage experiments at Whiteshell Laboratories must be made with caution.

17905 (DOE/CH/10441–1) **Near-Site Transportation Infrastructure Project: Final report.** Viebrock, J.M. (Nuclear Assurance Corp., Norcross, GA (United States)); Mote, N. Nuclear Assurance Corp., Norcross, GA (United States). Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90CH10441. Order Number DE92011425. Source: OSTI; NTIS; INIS; GPO Dep.

There are 122 commercial nuclear facilities from which spent nuclear fuel will be accepted by the Federal Waste Management System (FWMS). Since some facilities share common sites and some facilities are on adjacent sites, 76 sites were identified for the Near-Site Transportation Infrastructure (NSTI) project. The objective of the NSTI project was to identify the options available for transportation of spent-fuel casks from each of these commercial nuclear facility sites to the main transportation routes – interstate highways, commercial rail lines and navigable waterways available for commercial use. The near-site transportation infrastructure from each site was assessed, based on observation of technical features identified during a survey of the routes and facilities plus data collected from referenced information sources. The potential for refurbishment of transportation facilities which are not currently operational was also assessed, as was the potential for establishing new transportation facilities.

17906 (DOE/EA–0538) **Storage for the Fast Flux Test Facility unirradiated fuel in the Plutonium Finishing Plant Complex, Hanford Site, Richland, Washington.** USDOE Assistant Secretary for Nuclear Energy, Washington, DC (United States). Jan 1992. 29p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012193. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Assessment evaluates the proposed action to relocate and store unirradiated Fast Flux Test Facility fuel in the Plutonium Finishing Plant Complex on the Hanford Site, Richland, Washington. The US Department of Energy has decided to cease fuel fabrication activities in the 308 Building in the 300 Area. This decision was based on a safety concern over the ability of the fuel fabrication portion of the 308 Building to withstand a seismic event. The proposed action to relocate and store the fuel is based on the savings that could be realized by consolidating security costs associated with storage of the fuel. While the 308 Building belowgrade fuel storage areas are not at jeopardy by a seismic event, the US Department of Energy is proposing to cease storage operations along with the related fabrication operations. The US Department of Energy proposes to remove the unirradiated fuel pins and fuel assemblies from the 308 Building and store them in Room 192A, within the 234-5Z Building, a part of the Plutonium Finishing Plant Complex, located in the 200 West Area. Minor modifications to Room 192A would be required to accommodate placement of the fuel. The US Department of Energy estimates that removing all of the fuel from the 308 Building would save $6.5 million annually in security expenditures for the Fast Flux Test Facility. Environmental impacts of construction, relocation, and operation of the proposed action and alternatives were evaluated. This evaluation concluded that the proposed action would have no significant impacts on the human environment.

17907 (DOE/OR/21555–T2) **Monitored retrievable storage of spent nuclear fuel: Transportation studies: Draft.** Bronzini, M.S. (Tennessee Univ., Knoxville, TN (United States). Transportation Center); Middendorf, D.P.; Kinnison, H.A.; Miller, A.J. Jr.; Harrison, G.I.; Stammer, R.E. Jr.; Thackston, E.L.; Bowlby, W.; Huddleston, B. Tennessee Safe Growth Team, Nashville, TN (United States); Tennessee Univ., Knoxville, TN (United States). Transportation Center; Vanderbilt Univ., Nashville, TN (United States). Dept. of Civil and Environmental Engineering. 20 Oct 1986. 350p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011923. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) is preparing a proposal to Congress (1) to site in Tennessee a Monitored Retrievable Storage (MRS) facility for handling spent nuclear fuel. The MRS would gather spent fuel from all (or only Eastern) reactors, consolidate and repackage it, and send it on to the first nuclear waste permanent repository, which presumably will be located at a site in the West. Three repository sites have been recommended for detailed characterization studies–Deaf Smith Canyon, Texas; Yucca Mountain, Nevada; and Hanford, Washington. Sites recommended for the MRS are in Oak Ridge and Hartsville, Tennessee. (2) The purpose of this study was to estimate the transportation impacts of moving spent nuclear fuel, both with and without the proposed MRS facility. In order to make a fair comparison, the systems considered include measures to reduce transportation requirements, again with and without the MRS. Thus the study objective might be stated more broadly as "to estimate the transportation impacts of alternative systems for moving spent nuclear fuel from reactors to a repository." The purpose of making these impact estimates was to clarify the comparison between alternatives, rather than to determine their precise impacts or recommend any one of them. Both national and state level impacts were of concern.

17908 (DOE/OR/21555–T4) **Recommendations on the proposed Monitored Retrievable Storage Facility.** Clinch River MRS Task Force, Oak Ridge, TN (United States). Oct 1985. 239p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011926. Source: OSTI; NTIS; GPO Dep.

Following the Department of Energy's announcement in April 1985 that three Tennessee sites were to be considered for the Monitored Retrievable Storage facility, Governor Lamar Alexander initiated a review of the proposal to be coordinated by his Safe Growth Team. Roane County and the City of Oak Ridge, the local governments sharing jurisdiction over DOE's primary and secondary sites, were invited to participate in the state's review of the MRS proposal. Many issues related to the proposed MRS are being considered by the Governor's Safe Growth Team. The primary objective of the Clinch River MRS Task Force has been to determine whether the proposed Monitored Retrievable Storage facility should be accepted by the local governments, and if so, under what conditions. The Clinch River MRS Task Force is organized into an Executive Committee cochaired by the Roane County Executive and Mayor of Oak Ridge and three Study Groups focusing on environmental (including health and safety), socioeconomic, and transportation issues.

17909 (DOE/OR/21555–T5) **The public response to Monitored Retrievable Storage: An interim report.** Tennessee Dept. of Health and Environment, Nashville, TN (United States). 22 Oct 1985. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011927. Source: OSTI; NTIS; GPO Dep.

This report describes public opinion concerning the proposed monitored retrievable storage facility to be located in the vicinity of Oak Ridge, Tennessee. The majority of individuals who did express an opinion opposed the facility due to transport/safety concerns and environmental/health concerns. (CBS)

17910 (DOE/OR/21555–T6) **Transportation impacts on the Tennessee highway system proposed monitored retrievable storage: Final report.** Cobble, C. Tennessee Dept. of Transportation, Nashville, TN (United States). 12 Dec 1985. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011928. Source: OSTI; NTIS; GPO Dep.

The issue of the transport of spent fuels to the proposed monitored retrievable storage facility in Tennessee is discussed. Relevant issues include the ability of the roads and bridges on the transport routes to handle the weight of the trucks. (CBS)

17911 (DOE/OR/21555–T7) **Evaluation of the need, feasibility, and siting of the MRS in Tennessee: Draft final report.** Colglazier, E.W. Jr. (Tennessee Univ., Knoxville, TN (United States)). Tennessee Univ., Knoxville, TN (United States); Vanderbilt Univ., Nashville, TN (United States); Oak Ridge Associated Universities, Inc., TN (United States); Nuclear Assurance Corp., Norcross, GA (United States). 16 Dec 1985. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011929. Source: OSTI; NTIS; GPO Dep.

This summary report outlines the results of an independent assessment of the need, feasibility, and siting of the proposed Monitored Retrievable Storage (MRS) facility. The detailed reports of this assessment are included as appendices to the summary report. The Department of Energy (DOE) has concluded that the MRS is not absolutely necessary, but preferred, in order to manage and move spent fuel from reactors to a repository. The team has attemped to assess "need" by comparing to advantages and disadvantages of various systems, with and without the MRS. "Feasibility has been assessed by comparing the technical and economic advantages and disadvantages. The team was not asked to recommend a preferred system. That choice will depend on the importance that are used to compare alternatives. The five key criteria selected by the team for comparing alternate systems were: economic cost, radiological risk, non-radiological transportation impacts, the likelihood of successful implementation and operation of the system, and the likelihood of meeting the schedule in the Nuclear Waste Policy Act. The team compared twelve different systems and modeled the transportation impacts and risks with three repository sites and two MRS sites.

17912 (DOE/OR/21555–T8) **Environmental impacts of proposed Monitored Retrievable Storage: Final report.** Tennessee Dept. of Health and Environment, Nashville, TN (United States). 17 Dec 1985. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011930. Source: OSTI; NTIS; GPO Dep.

This report describes environmental impacts from a proposed monitored retrievable storage facility for spent fuels to be located in Tennessee. Areas investigated include: water supply, ground water, air quality, solid waste management, and health hazards. (CBS)

17913 (DOE/OR/21555–T9) **An economic analysis of a monitored retrievable storage site for Tennessee: Final report and appendices.** Fox, W.F.; Mayo, J.W.; Hansen, L.T.; Quindry, K.E. Tennessee Univ., Knoxville, TN (United States). Center for Business and Economic Research. 17 Dec 1985. 302p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011931. Source: OSTI; NTIS; GPO Dep.

The United States Department of Energy is charged with the task of identifying potential sites for a Monitored Retrievable Storage (MRS) Facility and reporting the results of its analysis to Congress by January 1986. DOE chose three finalist sites from 11 sites DOE analysts evaluated earlier. All three are in Tennessee, including two in Oak Ridge and one in Trousdale/Smith Counties. This paper is a summary of research undertaken on the economic effects of establishing the MRS facility in Tennessee. All three locations were considered in the analysis, but on some occasions attention is focused on the site preferred by DOE. The research was undertaken by the Center for Business and Economic Research (CBER), College of Business Administration, the University of Tennessee, Knoxville, under contract with the Tennessee Department of Economic and Community Development.

17914 (K/SS–546) **Cylinder yard inspections and corrective actions.** Barlow, C.R. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Ziehlke, K.T.; Pryor, W.A. Oak Ridge Gaseous Diffusion Plant, TN (United States). 31 Jul 1990. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE92011611. Source: OSTI; NTIS; GPO Dep.

Inspection of valves on stored uranium hexafluoride (UF_6) cylinders was initiated at the three diffusion plant sites in Oak Ridge, Tennessee, Paducah, Kentucky, and Portsmouth, Ohio as the result of the discovery of valve defects and evidence of valve leaks at the Oak Ridge K-25 plant. The coordinated inspection culminated in the identification of additional factors related to long-term safe storage of UF_6, and plans for correction of such deficiencies are presently being developed and implemented. These corrective actions supplement existing programs aimed at assurance of safe storage as summarized in the report.

17915 (PNL–7206) **Time/motion observations and dose analysis of reactor loading, transportation, and dry unloading of an overweight truck spent fuel shipment.** Hostick, C.J. (Pacific Northwest Lab., Richland, WA (United States)); Lavender, J.C.; Wakeman, B.H. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013600. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents observed activity durations and radiation dose analyses for an overweight truck shipment of pressurized water reactor (PWR) spent fuel from the Surry Power Station in Virginia to the Idaho National Engineering Laboratory. The shipment consisted of a TN-8L shipping cask carrying three 9-year-old PWR spent fuel assemblies. Handling times and dose analyses for at-reactor activities were completed by Virginia Electric and Power Company (Virginia Power) personnel. Observations of in-transit and unloading activities were made by Pacific Northwest Laboratory (PNL) personnel, who followed the shipment for approximately 2800 miles and observed cask unloading activities. In-transit dose estimates were calculated using dose rate maps provided by Virginia Power for a fully loaded TN-8L shipping cask. The dose analysis for the cask unloading operations is based on the observations of PNL personnel.

17916 (SAND–91-1977C) **Applications of RADTRAN 4 to route-specific analysis.** Neuhauser, S. (Sandia National Labs., Albuquerque, NM (United States)); Weiner, R.F. Sandia National Labs., Albuquerque, NM (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920307–65: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992; TTC–1091). Order Number DE92011184. Source: OSTI; NTIS; INIS; GPO Dep.

The transportation risk evaluation code RADTRAN 4 is designed to evaluate doses and risks associated with the transportation of radioactive materials (Ne92). RADTRAN 4 may be used to calculate dose consequences for incident-free transportation and dose risks for accidents. Consequences of normal (or incident-free) transportation include doses to crew members, persons at stops, and members of the public sharing a route segment (on-link) and residing near the segment (off-link) during normal transportation.

These dose estimates are not multiplied by a probability factor and, hence, are referred to as dose consequences. Calculated doses that might be incurred during accidents are multiplied by the probabilities of those accidents, and hence are referred to as dose risks. RADTRAN 4 includes a LINK option that allows the user to characterize each link or segment of a transportation route in greater detail than that provided by average or default values for route-related parameters.

17917 (SAND–91-2780) **Summary of outgassing tests performed in support of the AL-SX (H1616) Program.** York, A.R. II; Thornberg, S.M. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011513. Source: OSTI; NTIS; GPO Dep.

The AL-SX/2 and AL-SX/3 are recently certified Type B shipping containers for tritium reservoirs. Both containers consist of an outer stainless steel drum overpack and sealed stainless steel containment vessel. WR reservoirs provide containment of tritium for normal conditions of transport. In accident conditions the containment vessel of the AL-SX must contain the tritium. A variety of reservoirs and materials will be packaged inside the containment vessel. These materials must not produce high pressure gas products that exceed the internal pressure capability of the vessel if the container is in an accident involving fire. This report summarizes outgassing tests performed on various organic materials. Tests of commonly used materials show that increased pressure due to outgassing is not a problem at elevated temperatures that simulate an accident. This report summarizes outgassing tests performed on various materials that may be packaged inside the AL-SX during shipment. These materials (except the getter) are normally a part of the reservoir shipping configuration. The objective of the tests was to determine the temperature that these materials begin to generate high pressure gaseous products.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 17908, 17909, 17910, 17913, 17960, 17962, 18041, 18049, 18597

17918 (ANL/EAIS/TM–68) **Update of identification and estimation of socioeconomic impacts resulting from perceived risks and changing images: An annotated bibliography.** Nieves, L.A.; Clark, D.E.; Wernette, D. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Aug 1991. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012258. Source: OSTI; NTIS; INIS; GPO Dep.

This annotated bibliography reviews selected literature published through August 1991 on the identification of perceived risks and methods for estimating the economic impacts of risk perception. It updates the literature review found in Argonne National Laboratory report ANL/EAIS/TM-24 (February 1990). Included in this update are (1) a literature review of the risk perception process, of the relationship between risk perception and economic impacts, of economic methods and empirical applications, and interregional market interactions and adjustments; (2) a working bibliography (that includes the documents abstracted in the 1990 report); (3) a topical index to the abstracts found in both reports; and (4) abstracts of selected articles found in this update.

0520 Waste Management

Refer also to citation(s) 17905, 17907, 17918, 18097, 18101, 18102, 18103, 18104, 18109, 18110, 18111, 18112, 18118, 18123, 18344, 18619, 18797, 18979, 18980, 18987, 19039, 19055, 19085, 19086, 19320, 19405, 19445, 19453, 19471, 19482, 19483, 19485, 19492, 19497, 19498, 19499, 19500, 19501, 19513, 19539, 19542, 19543, 19561, 19564, 19917, 19954, 20472, 20479, 20554, 20620

17919 (AECL–10009) **The solubility of U, Np, Pu, Th and Tc in a geological disposal vault for used nuclear fuel.** Lemire, R.J.; Garisto, F. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Dec 1989. 131p. Order Number DE92627044. Source: OSTI; NTIS (US Sales Only); INIS.

This document describes the solubility model used to calculate the concentrations of uranium, thorium, technetium, neptunium and plutonium in a geological disposal vault for used nuclear fuel. This model is incorporated in the vault model of SYVAC3-CC3 - the third generation of the Systems Variability Analysis Code used to assess the long-term safety of the disposal of Canada's nuclear fuel waste. The data for the solubility model and the sources for these data are also reported.

17920 (AECL–10183/F) **Nuclear fuel waste disposal in Canada: The generic research program.** Dormuth, K.W.; Gillespie, P.A. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. May 1990. 36p. (In French). Order Number DE92627045. Source: OSTI; NTIS (US Sales Only); INIS.

Atomic Energy of Canada Limited (AECL) has developed a concept for disposing of Canada's nuclear fuel waste and is submitting it for review under Federal Environmental Assessment and Review Process. During this review, AECL intends to show that careful, controlled burial 500 to 1000 metres deep in plutonic rock of the Canadian Precambrian Shield is a safe and feasible way to dispose of Canada's nuclear fuel waste. The concept has been assessed without identifying or evaluating any particular site for disposal. AECL is now preparing a comprehensive report based on more than 10 years of research and development.

17921 (AECL–10300) **A survey of methods to immobilize tritium and carbon-14 arising from a nuclear fuel reprocessing plant.** Taylor, P. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Feb 1991. 33p. Order Number DE92627039. Source: OSTI; NTIS (US Sales Only); INIS.

This report reviews the literature on methods to separate and immobilize tritium (^{3}H) and carbon-14 (^{14}C) released from $U0_2$ fuel in a nuclear fuel reprocessing plant. It was prepared as part of a broader review of fuel reprocessing waste management methods that might find future application in Canada. The calculated inventories of both ^{3}H and ^{14}C in used fuel are low; special measures to limit releases of these radionuclides from reprocessing plants are not currently in place, and may not be necessary in future. If required, however, several possible approaches to the concentration and immobilization of both radionuclides are available for development. Technology to control these radionuclides in reactor process streams is in general more highly developed than for reprocessing plant effluent, and some control methods may be adaptable to reprocessing applications.

17922 (AECL–10380) **The COSMOS-3 assessment code for LLRW repositories.** Wilkinson, S.R.; Selander, W.N.; Rowat, J.H.; Ruddock, V.; Briden, B.; Lane, F. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Nov 1991. 21p. Order Number DE92627046. Source: OSTI; NTIS (US Sales Only); INIS.

The code COSMOS-3 has been developed at Chalk River Laboratories as part of the safety assessment methodology for the disposal of low-level radioactive waste (LLRW). Radiation dose equivalents as a consequence of the escape and migration of radionuclei from near surface disposal facilities are predicted. This report describes the features available in the present Version 3 of COSMOS. The physical processes represented by each major submodel are described, with references to other documents containing more details. Changes in the vault model of an earlier version of COSMOS resulting in version 3, including a change in emphasis from nuclide concentration to nuclide flux as the simulation variable, have provided an improved ability to model the behavior of the engineered system of the disposal facility. As a consequence of increased computer time necessary for such modelling, however, the use of COSMOS-3 as a stochastic or probabilistic systems assessment code is limited.

17923 (AECL–10430) **Mine-by experiment final design report.** Read, R.S.; Martin, C.D. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment; Ontario Hydro, Toronto, ON (Canada). Dec 1991. 73p.

(COG–91-305.). Order Number DE92627047. Source: OSTI; NTIS (US Sales Only); INIS.

The Underground Research Laboratory (URL) Mine-by Experiment is designed to provide information on rock mass response to excavation that will be used to assess important aspects of the design of a nuclear fuel waste disposal vault in a granitic pluton. The final experiment design is the result of a multidisciplinary approach, drawing on experience gained at other sites as well as the URL, and using both internal expertise and the external consultants. The final experiment design, including details on characterization, construction, instrumentation, and numerical modelling, is presented along with final design drawings.

17924 (ANL–92-9) **ANL Technical Support Program for DOE Environmental Restoration and Waste Management: Annual report, October 1990–September 1991.** Bates, J.K. (Argonne National Lab., IL (United States)); Bradley, C.R.; Buck, E.C.; Cunnane, J.C.; Dietz, N.L.; Ebert, W.L.; Emery, J.W.; Feng, X.; Gerding, T.J.; Gong, M.; Hoh, J.C.; Mazer, J.J.; Wronkiewicz, D.J.; Bourcier, W.L.; Morgan, L.E.; Nielsen, JArgonne National Lab., IL (United States); Lawrence Livermore National Lab., CA (United States). Mar 1992. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92011753. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an overview of progress during FY 1991 for the Technical Support Program that is part of the ANL Technology Support Activity for DOE, Environmental Restoration and Waste Management (EM). The purpose is to evaluate, before hot start-up of the Defenses Waste Processing Facility (DWPF) and the West Valley Demonstration Project (WVDP), factors that are likely to affect glass reaction in an unsaturated environment typical of what may be expected for the candidate Yucca Mountain repository site. Specific goals for the testing program include the following: (1) to review and evaluate available information on parameters that will be important in establishing the long-term performance of glass in a repository environment; (2) to perform testing to further quantify the effects of important variables where there are deficiencies in the available data; and (3) to initiate long-term testing that will bound glass performance under a range of conditions applicable to repository disposal.

17925 (ANL/CP–74200) **Initial comparison of leach behavior between fully radioactive and simulated nuclear waste glasses through long-term testing: Part 1, Solution analysis.** Feng, Xiangdong; Bates, J.K. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920430–70: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92010516. Source: OSTI; NTIS; INIS; GPO Dep.

A comparison of glass reactivity between radioactive sludge based and simulated nuclear waste glasses has been made through long-term testing of both glass types for SRL 165, SRL 131, and SRL 200 frit compositions. The data demonstrate that for time periods through 280 days, differences in elemental release to solution up to 400% are observed. However, in general, differences in glass reactivity as measured by the release of boron, lithium, and sodium are less than a factor of two. The differences in reactivity are not large enough to alter the order of glass durability for the different compositions or to change the controlling glass dissolution mechanism. A radiation effect exists, mainly in the influence on the leachate pH, which in turn affects the glass reaction mechanism and rate. The differences in reactivity between fully radioactive and the simulated glasses can be reasonably explained if the controlling reaction mechanism is accounted for. Those differences are glass composition and leaching mechanism dependent. Lithium is found to have the highest elemental release in an ion-exchange dominated glass reaction process, while lithium has a lower release than boron and sodium in a matrix dissolution dominated process, where boron and sodium are usually among the most concentrated solution species.

17926 (ANL/CP–74206) **A comparison of glass reaction at high and low SA/V: PCT vs MCC-1.** Ebert, W.L.; Bates, J.K. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920430–73: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92010887. Source: OSTI; NTIS; INIS; GPO Dep.

Leach tests have been performed at surface area/volume (SA/V) of 10, 2000, and 20,000 m^{-1} using actinide-doped borosilicate waste glass (SRL 131 and SRL 202) to assess the effects of the SA/V on the mechanism and rate of the glass reaction. Solution results are presented which show the major effect of the SA/V to be dilution. Higher SA/V result in higher leachate pH values being attained due to initial ion exchange reactions. The higher pH values then accelerate hydrolysis of the glass. Colloids rich in aluminum and iron form at high SA/V after very little glass has reacted. Actinides released during glass reaction sorb onto these colloids which eventually become large enough to settle out of solution. The measured response is sensitive to the SA/V of the test, and is dominated by ion exchange at 10 m^{-1}, by matrix dissolution at 2000 m^{-1}, and by colloid formation at 20,000 m^{-1} within laboratory test timeframes.

17927 (AX–720936) **Characterization plan for TNX Burying Ground, Savannah River Plant.** Kelley, J.A. (CH2M Hill Southeast, Inc., Atlanta, GA (United States)). Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; CH2M Hill Southeast, Inc., Atlanta, GA (United States). 11 May 1988. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013127. Source: OSTI; NTIS; INIS; GPO Dep.

The TNX Burying Ground, which is located within the TNX security fenceline, was originally built in 1953 for the disposal of waste and debris from an experimental evaporator explosion. The material buried contained approximately 590 kg of uranyl nitrate, with unspecified amounts of tin, conduit, timbers, and other debris. Partial removals were performed in the early 1980s when the waste was encountered during the construction of buildings and process structures at TNX. This Characterization Plan has been prepared to fulfill requirements outlined in the "Scope of Work for Technical Assistance on Characterization of the TNX Burying Ground." This plan provides recommendations for collection of technical data to characterize the Savannah River Plant (SRP) TNX Burying Ground by identifying the numbers, types, depths, and locations of samples, the analyses to be performed, and the methodologies for collection.

17928 (BfS-ET–3/90) **Qualifications and standards to be met by radioactive waste to be accepted for ultimate disposal. (Preliminary acceptance criteria, as of April 1990) - national repository in the Konrad mine.** Brennecke, P.; Warnecke, E. (eds.). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Apr 1990. 91p. (In German). Order Number DE92511570. Source: OSTI; NTIS (US Sales Only); INIS.

Safety analyses have been made in order to prove the safety of the planned national repository in the Konrad mine during the operational phase and after sealing. The results of these analyses have been incorporated into the waste acceptance criteria presented in the publication. These define the requirements to be met by radioactive waste planned to be delivered to the Konrad mine. As these criteria are subject to official approval by the plan approval decision for the entire Konrad mine project, the criteria are termed to be preliminary. There may emerge further acceptance criteria during the plan approval procedure, which will be approved of in a package together with the plan approval decision. (orig./HP).

17929 (BfS-ET–3/90-REV-1) **Qualifications and standards to be met by radioactive waste to be accepted for ultimate disposal. (Preliminary acceptance criteria of April 1990, as amended in July 1991) - national repository in the Konrad mine.** Brennecke, P.; Warnecke, E. (eds.). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Jul 1991. 90p. (In German). Order Number DE92511569. Source: OSTI; NTIS (US Sales Only); INIS.

Safety analyses have been made in order to prove the safety of the planned national repository in the Konrad mine during the operational phase and after sealing. The results of these analyses have been incorporated into the waste acceptance criteria presented in the publication. These define the requirements to be met by radioactive waste planned to be delivered to the Konrad mine. As these criteria are subject to official approval by the plan approval decision for the entire Konrad mine project, the criteria are termed to be preliminary. There may emerge further acceptance criteria during the plan approval procedure, which will be approved of in a package together with the plan approval decision. (orig./HP).

17930 (BfS-ET--5/90-REV-1) **Simplified method of checking the observance of maximum permissible activity of waste forms to be placed in the Konrad mine for final waste storage.** Berg, H.P. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Aug 1991. 20p. (In German). Order Number DE92506634. Source: OSTI; NTIS (US Sales Only); INIS.

The requirements to be met by all waste forms intended for final storage in the Konrad ore mine define maximum permissible activity levels which result from the various parts of the safety analyses. For waste forms with very low activity levels, it is suitable to summarize those very specific requirements and perform the checking as simply as possible. The derivation of activity limit values for such a simplified checking of the observance of maximum permissible activities for waste forms is explained. The amended version of the Radiation Protection Ordinance, which came into force on 1 November 1989, and the General Administrative Regulation on paragraph 45 of the Radiation Protection Ordinance, of 1990, form the basis for the maximum permissible activity levels. (orig.).

17931 (BfS-ET--11/91) **Amount of radioactive wastes in the Federal Republic of Germany - waste inquiry for the year 1990.** Warnecke, E.; Hollmann, A. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Oct 1991. 35p. (In German). Order Number DE92511575. Source: OSTI; NTIS (US Sales Only); INIS.

On December 31,1990, the volume of unconditioned radioactive wastes with negligible heat generation amounted to some 14,900 m^3, appr. 4,000 m^3 of this from the new Federal states. To be added are about 1,600 m^3 of waste stored for decay, some 100 m^3 of this amount stored in the new Federal states. The volume of conditioned radioactive wastes with negligible heat generation amounted to some 50,000 m^3, of these only 150 m^3 coming from the new Federal states. Approx. 6,900 m^3 wastes were produced in 1990. Some 800 m^3 originate from the new Federal states; approx. 700 m^3 of these have been stored at the Morsleben repository for radioactive waste (ERAM), i.e. there was no need for interim storage. Approx. 43% of the interim storage capacity is utilized at present. A prognosis of the radioactive waste volume until the end of the year 200 has resulted in a bandwidth of approx. 147,600 m^3 to 174,300 m^3. The intersecting point between the wastes to be expected (upper value) and the interim storage capacity lies around the year 1997, which is very close to the time when Konrad final repository is expected to go into operation. The unconditioned heat-generating waste volume amounts to approx. 73 m^3 and comes from WAK. The conditioned waste volume amounts to some 570 m^3. Approx. 90 m^3 were produced in 1990. It is expected that the volume of conditioned waste will remain at the present bandwidth of approx. 20 to 90 m^3 a year until wastes from the reprocessed spent fuel elements from German nuclear power plants have to be taken back from abroad. For these, sufficient interim storage capacities have to be made available as final storage of heat-generating wastes in the Gorleben salt dome will not be possible before the year 2008. (orig./HP).

17932 (BfS-ISH--156/91) **Improvement and redevelopment of radioecological models for individual dose calculations at disposing low-level contaminated conventional wastes. Final report.** Poschner, J.; Schaller, G.; Wirth, E. Bundesamt fuer Strahlenschutz, Neuherberg (Germany). Inst. fuer Strahlenhygiene. Dec 1991. 117p. (In German). Contract St.Sch. 1104. Order Number DE92511501. Source: OSTI; NTIS (US Sales Only); INIS.

Using radioecological models, limits for the specific activity of low-activity waste containing natural radionuclides were established. These limits were determined in order to avoid dose equivalents of more than 10 μSv/a at disposing the waste in conventional waste deposits. For a group of radionuclides we determined limits, which are at least an order of magnitude greater than the natural occuring specific activity of these nuclides; therefore it is possible to put these limits into practice: K-40, Rb-87, Te-123, La-138, Sm-147, Lu-176, Pb-210, Pb-212, Bi-210, Po-210, Ra-223, Ra-224, Ac-227, Ac-228, Th-227, Th-231, Th-234, Pa-231, U-234, U-235 and U-238. In contrast to the obove stated radionuclides the determined limits for the third group of nuclides are similar to their natural activity so that an application of these limits is not possible without regarding the special disposal conditions: Ra-226, Ra-228, Th-228, Th-230 und Th-232. (orig.).

17933 (CEA-CONF--10503) **Sampling analytical tests and destructive tests for quality assurance.** Saas, A. (CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (FR)); Pasquini, S.; Jouan, A.; Angelis, de; Hreen Taywood, H.; Odoj, R. CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). 1990. 17p. (CONF-9009208--: 3. European community conference on radioactive waste management and disposal, Luxembourg (Luxembourg), 17-21 Sep 1990). Order Number DE92517855. Source: OSTI; NTIS (US Sales Only); INIS.

In the context of the third programme of the European Communities on the monitoring of radioactive waste, various methods have been developed for the performance of sampling and measuring tests on encapsulated waste of low and medium level activity, on the one hand, and of high level activity, on the other hand. The purpose was to provide better quality assurance for products to be stored on an interim or long-terme basis. Various testing sampling means are proposed such as: - sampling of raw waste before conditioning and determination of the representative aliquot, - sampling of encapsulated waste on process output, - sampling of core specimens subjected to measurement before and after cutting. Equipment suitable for these sampling procedures have been developed and, in the case of core samples, a comparison of techniques has been made. The results are described for the various analytical tests carried out on the samples such as: - mechanical tests, - radiation resistance, - fire resistance, - lixiviation, - determination of free water, - biodegradation, - water resistance, - chemical and radiochemical analysis. Every time it was possible, these tests were compared with non-destrutive tests on full-scale packages and some correlations are given. This word has made it possible to improve and clarify sample optimization, with fine sampling techniques and methodologies and draw up characterization procedures. It also provided an occasion for a first collaboration between the laboratories responsible for these studies and which will be furthered in the scope of the 1990-1994 programme.

17934 (CEA-CONF--10529) **Engineering solution for the backfilling and sealing of radioactive waste repositories.** Jorda, M. (CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (FR). Direction du Cycle du Combustible); Boisson, J.Y.; Andre-Jehan, R.; Gouvenot, D.; Bonne, A.; Lees, T.P. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Direction du Cycle du Combustible. 1990. 15p. (CONF-9009208--: 3. European community conference on radioactive waste management and disposal, Luxembourg (Luxembourg), 17-21 Sep 1990). Order Number DE92517854. Source: OSTI; NTIS (US Sales Only); INIS.

To ensure the safety of radioactive waste deep disposal, backfilling and sealing materials (engineered barriers) have to be used to fill residual voids. For granite medium, stress is put on emplacement techniques for cement- and clay-based materials, including in-situ validation. For clay medium, mined repository and deep boreholes drilled from the surface are considered. In the case of the first solution, the thermomechanical behaviour of a clay backfill is studied. In the same way, backfill made of excavated crushed salt is considered and thermomechanical properties evaluated by means of laboratory tests and in-situ experiments. Finally, basic works on quality assurance procedures and historic concretes behaviour are reported.

17935 (CEA-DAS–747) **Performance evaluation of repositories in deep geological formations for the medium level and alpha waste. The Pacoma project, granite option.** Cernes, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Inst. de Protection et de Surete Nucleaire); Brun-Yaba, C.; Lewi, J. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. 1990. 13p. (CONF-9009208–: 3. European community conference on radioactive waste management and disposal, Luxembourg (Luxembourg), 17-21 Sep 1990). Order Number DE92517863. Source: OSTI; NTIS (US Sales Only); INIS.

After the CEC PAGIS project (for vitrified waste), the PACOMA project started at the end of 1987 for medium level and alpha waste. The CEA-IPSN has been in charge of the granite option. For the PACOMA project, a representative inventory of waste has been built up, a repository concept (with one variant) has been defined and an adaptation of the near field module CONDIMENT of the safety evaluation code MELODIE, has been made in order to take into account the particularities of cemented waste with respect to the vitrified waste. For the normal evolution scenario, best-estimate calculations have been performed for a reference site (the french Auriat site) which is an outcropping granite and for two variants, the first one representing a coastal granite formation (Barfleur) and the other one, a granite with a sedimentary cover (notional British site). Sensitivity and uncertainty analysis have been performed with a 2D modelling of the geosphere (module METIS of the MELODIE code) instead of the 1D modelling (stream tube) previously used in the PAGIS project. After a general presentation of these points, the main results, namely the dose rates obtained through deterministic calculations, and the most important geosphere parameters, are presented.

17936 (CONF-901264–) **Proceedings of the workshop on radioactive, hazardous, and/or mixed waste sludge management.** Lomenick, T.F. (ed.). Oak Ridge K-25 Site, TN (United States). Jan 1992. 363p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. From Workshop on radioactive, hazardous, and/or mixed wastes sludge management; Knoxville, TN (United States); 4-5 Dec 1990. Order Number DE92012667. Source: OSTI; NTIS; INIS; GPO Dep.

A workshop sponsored by the US Department of Energy (DOE) Field Office, Oak Ridge, was held on December 4–6, 1990, in Knoxville, Tennessee. The primary objective of the workshop was the exchange of information, experiences, solutions, and future plans of DOE and its prime contractors who are engaged in work on the packaging, grouting, storage, and transport of waste sludges. In addition, the group met with industrial participants in an open forum to discuss problems and needs in the management of these wastes and to learn of possible industrial experiences, approaches, and solutions, including demonstrations of potential tools and techniques. Topics discussed include the following: mixed waste sludge issue at the K-25 site; processing saltstone from waste streams at the Savannah River Plant; the Hanford Grout Treatment Facility; treatment of pond sludge at the Rocky Flats Plant; cement solidification of low-level radioactive sludge at the West Valley Demonstration Project; studies on the solidification of low-level radioactive wastes in cement at INEL; cement solidification systems at Los Alamos National Laboratory; emergency avoidance solidification campaign at ORNL; diffusion plant sludge storage problems at the Portsmouth Gaseous Diffusion Plant; the proposed fixation of sludge in cement at the feed materials production center; regulatory aspects of sludge management; and delisting efforts for K-1407-C pond sludges. Individual projects are processed separately for the data bases.

17937 (CONF-920466–7) **Opportunities for artificial intelligence application in computer- aided management of mixed waste incinerator facilities.** Rivera, A.L.; Ferrada, J.J.; Singh, S.P.N. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992. Order Number DE92011785. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy/Oak Ridge Field Office (DOE/OR) operates a mixed waste incinerator facility at the Oak Ridge K-25 Site. It is designed for the thermal treatment of incinerable liquid, sludge, and solid waste regulated under the Toxic Substances Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA). This facility, known as the TSCA Incinerator, services seven DOE/OR installations. This incinerator was recently authorized for production operation in the United States for the processing of mixed (radioactively contaminated-chemically hazardous) wastes as regulated under TSCA and RCRA. Operation of the TSCA Incinerator is highly constrained as a result of the regulatory, institutional, technical, and resource availability requirements. These requirements impact the characteristics and disposition of incinerator residues, limits the quality of liquid and gaseous effluents, limit the characteristics and rates of waste feeds and operating conditions, and restrict the handling of the waste feed inventories. This incinerator facility presents an opportunity for applying computer technology as a technical resource for mixed waste incinerator operation to facilitate promoting and sustaining a continuous performance improvement process while demonstrating compliance. Demonstrated computer-aided management systems could be transferred to future mixed waste incinerator facilities.

17938 (CORR-87-0117-Rev.3) **A characterization study of the Old F-Area Seepage Basin at the United States Department of Energy's Savannah River Plant: Revision 3.** Shedrow, C.B. (Shedrow (C.B.) Environmental Consultants, Inc., Columbia, SC (United States)). Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Shedrow (C.B.) Environmental Consultants, Inc., Columbia, SC (United States). Mar 1987. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92013123. Source: OSTI; NTIS; GPO Dep.

The Old F-Area Seepage Basin of Savannah River Plant (Building No. 904-49G), which is located outside of the F-Area perimeter security fence and north of the 221-F building, was constructed as a test facility in 1954 to treat waste flows from the F-Area chemical separations facilities. The basin possesses a surface area of approximately 1.3 acres and is partially subdivided into two cells. It is estimated that up to 13.7 million gallons of aqueous process wastes were discharged to this basin during its operation. Overflow from the basin was discharged into an unnamed tributary of Upper Three Runs Creek. In 1955 the basin was taken offline because its seepage rate was inadequate to assimilate increased waste flows generated by the chemical separations facilities. However, the old basin has been used intermittently to treat storm water runoff and process effluents from the F-2 Outfall. The basin presently contains approximately 18 inches of accumulated rain water. The objective of this investigation was to identify the chemical and radiological constituents associated with the Old F-Area Seepage Basin and define their spatial distribution within the basin's bottom sediments. The analytical results are presented.

17939 (DOE/EH–0240P) **Environmental Audit of the Environmental Measurements Laboratory (EML).** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Audit. Feb 1992. 137p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011740. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the findings identified during the Environmental Audit of the Environmental Measurements Laboratory (EML), conducted from December 2 to 13, 1991. The Audit included the EML facility located in a fifth-floor General Services Administration (GSA) office building located in New York City, and a remote environmental monitoring station located in Chester, New Jersey. The scope of this Environmental Audit was comprehensive, covering all areas of environmental activities and waste management operations, with the exception of the National Environmental Policy Act (NEPA), which is the responsibility of the DOE Headquarters Office of NEPA Oversight. Compliance with applicable Federal, state, and local requirements; applicable DOE Orders; and internal facility requirements was addressed.

17940 (DOE-HMIP-RR–90.069) **Centrifuge modelling - migration of radionuclides from engineered trenches.** Dean, E.T.R. (Cambridge Univ. (United Kingdom). Dept. of Engineering);

Schofield, A.N. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Dec 1991. 235p. Contract PECD-7/9/401. Order Number DE92628328. Source: OSTI; NTIS (US Sales Only); INIS.

This report provides an overview of some centrifuge small-scale physical model tests and 1g experimental and theoretical work relating to the sub-surface migration of a model pollutant (sodium chloride) from a notional prototype surface landfill of width 25 metres and depth 3 metres cut into a 20 metre deep layer of nominally uniform soil overlying a more permeable base layer. An introduction is given to the application of geotechnical centrifuge modelling techniques to pollutant migration studies. Experiments performed at 1/100th scale using the Cambridge 10 metre diameter Geotechnical Beam Centrifuge simulating transport through silt over prototype time periods of around 35 years, are summarised. Comparisons of data with calculations using early versions of the POLLUTE and MIGRATE computer codes are presented. An experiment at 1/400th scale using the new Cambridge Geotechnical Drum Centrifuge, involving transport through clay over a prototype time period of around 1000 years, is described. Potential future uses of centrifuge modelling techniques to simulate long-term migration through more complex hydrological environments are also discussed. (author).

17941 (DOE-HMIP-RR--91.012) **Product Evaluation Task Force Phase Two report for CAGR graphite.** Francis, A.J. (British Nuclear Fuels plc, Risley (United Kingdom)); Davies, A. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution; British Nuclear Fuels plc, Risley (United Kingdom). 1991. 34p. (ILWRP--86-P02.). Order Number DE92628321. Source: OSTI; NTIS (US Sales Only); INIS.

It has been proposed that all Intermediate Level Wastes arising at Sellafield should be encapsulated prior to ultimate disposal. The Product Evaluation Task Force (PETF) was set up to investigate possible encapsulants and to produce an adequate data base to justify the preferred matrices. This report details the work carried out under Phase 2 of the Product Evaluation Task Force programme, on CAGR graphite. Three possible types of encapsulants for CAGR graphites:-Inorganic cements, Polymer cements and Polymers are evaluated using the Kepner Tregoe decision analysis technique. This technique provides a methodology for scoring and ranking alternative options and evaluating any risks associated with an option. The analysis shows that for all four stages of waste management operations ie Storage, Transport, handling and emplacement, Disposal and Process, cement matrices are considerably superior to other potential matrices. A matrix, consisting of three parts Blast Furnace Slag (BFS) to one part Ordinary Portland Cement (OPC) is recommended as the preferred matrix for Phase 3 studies on CAGR graphite. (author).

17942 (DOE-HMIP-RR--91.013) **Product Evaluation Task Force Phase Two report for MEB crud/filter aid.** Francis, A.J. (British Nuclear Fuels plc, Risley (United Kingdom)). Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution; British Nuclear Fuels plc, Risley (United Kingdom). 1991. 32p. (ILWRP--85-P13.). Order Number DE92628322. Source: OSTI; NTIS (US Sales Only); INIS.

It has been proposed that all Intermediate Level Wastes arising at Sellafield should be encapsulated prior to ultimate disposal. The Product Evaluation Task Force (PETF) was set up to investigate possible encapsulants and to produce an adequate data base to justify the preferred matrices. This report details the work carried out, under Phase 2 of the Product Evaluation Task Force programme, on MEB Crud/Filter Aid. Three possible types of encapsulants for MEB Crud/Filter Aid:- Inorganic cements, Polymer cements, and Polymers are evaluated using the Kepner Tregoe decision and analysis technique. This technique provides a methodology for scoring and ranking alternative options and evaluating any risks associated with an option. The analysis shows that for all four stages of waste management operations, ie Storage, Transport, handling and emplacement, Disposal and, Process, cement matrices are considerably superior to other potential matrices. A matrix, consisting of nine parts Blast Furnace Slag (BFS) to one part Ordinary Portland Cement (OPC) is recommended as the preferred matrix for Phase 3 studies on MEB/Filter Aid. (author).

17943 (DOE-HMIP-RR--91.036) **The migration of colloidal particles through glacial sand.** Harrison, I. (British Geological Survey, Keyworth (United Kingdom)); Higgo, J.J.W.; Leader, R.; Noy, D.; Smith, B.; Wealthall, G.; Williams, G.M. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Feb 1991. 52p. Contract PECD-7/9/534;WE/91/11. Order Number DE92628329. Source: OSTI; NTIS (US Sales Only); INIS.

Significant concentrations of colloids exist in groundwater and radionuclides may be associated with this colloidal material. This must be taken into consideration in any safety case for a radionuclide waste repository. This report describes column experiments with monodisperse latex beads. A selection of beads with diameters ranging from 0.055 μm to 0.6 μm, some plain and some with carboxyl groups attached, were passed through columns of glacial sand. The breakthrough curves and profiles on the sand columns were studied and will be used to develop and validate colloid migration models. The mobility depended on both size and charge, and the beads appeared to move ahead of a 36Cl tracer until they were trapped. After trapping movement was slow with plain beads appearing to be slightly more mobile than carboxylated beads. The beads were shown to sorb strongly on the fine clay particles in the sand and there was evidence to suggest that they moved with the fines rather than independently. (author).

17944 (DOE-HMIP-RR--91.043) **Experimental investigation of factors affecting the control of redox conditions within a radwaste repository.** Guppy, R.M. (AEA Industrial Technology, Harwell (United Kingdom)); Atkinson, A. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Apr 1991. 51p. Contract PECD-7/9/504. (AEA-D and R--0152.). Order Number DE92627048. Source: OSTI; NTIS (US Sales Only); INIS.

The maximum aqueous concentration of multivalent radioelements in a radwaste repository can be estimated from the expected Eh (the oxidising or reducing tendency of the solution) and pH of the aqueous phase in the repository so long as equilibrium between all oxidising and reducing species can be guaranteed. The objective of the work reported here was to ascertain whether any significant departures from redox equilibrium are likely to arise. Technetium (VII) species were exposed under anaerobic conditions to concentrations of ferrous, hydrogen sulphide and thiosulphate species likely to be present in a repository environment to establish which species are capable of reducing aqueous Tc(VII) to a less soluble Tc(IV) solid compound. Potential catalytic solid phases and phases capable of electron exchange were also exposed to Tc(VII) species under anaerobic, aerobic and hydrogen atmospheres. We have not been able to demonstrate conclusively that mutual equilibrium was attained between technetium and iron redox couples, nor that the apparent solubility of technetium was that expected from the resulting Eh and pH of the solution, although some technetium was removed from solution. Hydrogen did not reduce Tc(VII) within the timescale of the experiments and no catalytic effects by haematite or a cementitious backfill grout for reductions involving hydrogen were observable. Magnetite removed some technetium from solution, apparently by surface reaction, under inert (argon) and reducing (hydrogen) atmospheres. Sulphides, and to a lesser extent thiosulphates, will reduce the solubility of technetium to a very low level. (author).

17945 (DOE-HMIP-RR--91.048) **A gas migration test in saturated, fractured rock: Final report for the Joint UKDOE/AECL Project. Phase 2.** Gascoyne, M. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Labs.); Wuschke, D.M.; Brown, A.; Hayles, J.G.; Kozak, E.T.; Lodha, G.S.; Thorne, G.A. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. 1991. 95p. Contract PECD-7/9/440. Order Number DE92628330. Source: OSTI; NTIS (US Sales Only); INIS.

Helium gas was injected at constant pressure into an inclined fracture zone through an access borehole at a depth of about 40 m, in the Lac du Bonnet granite, southeastern Manitoba. The gas flow rate, arrival time and pattern of distribution of gas at the surface were monitored by soil gas surveys. The field results were compared with predictions of a simple analytical model. Good agreement was found when the influence of vertical fracturing in the bedrock and a low-permeability overburden were included in the model. The model was then used to determine the hydraulic conductivity of individual gas flow paths in the fractured rock. (author).

17946 (DOE-HMIP-RR–92.006) **Conceptual designs for waste quality checking facilities for low level and intermediate level radioactive wastes and hazardous waste.** Driver, S. (Taylor Woodrow Management and Engineering Ltd. (TAYMEL), Winfrith Technology Centre, Dorchester (United Kingdom). Waste Quality Checking Lab.); Griffiths, M.; Leonard, C.D.; Smith, D.L.G. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Jan 1992. 76p. Contract PECD-7/9/528;WQCL02. Order Number DE92628331. Source: OSTI; NTIS (US Sales Only); INIS.

This report summarises work carried out on the design of facilities for the quality checking of Intermediate and Low Level Radioactive Waste and Hazardous Waste. The procedures used for the quality checking of these categories of waste are summarised. Three building options are considered: a separate LLW facility, a combined facility for LLW and HW and a Waste Quality Checking Facility for the three categories of waste. Budget Cost Estimates for the three facilities are given based on 1991 prices. (author).

17947 (DOE-HMIP-RR–92.007) **Quality checking of radioactive and hazardous waste: September 1989 to August 1991.** Billington, D.M. (and others); Burgoyne, S.M.J.; Dale, C.J. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Jan 1992. 208p. Contract PECD-7/9/528;WQCL01. Order Number DE92628332. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the work of the HMIP Waste Quality Checking Laboratory (WQCL) for the period September 1989 -August 1991. The WQCL has conducted research and development of procedures for the receipt, sampling and analysis of low level solid radioactive waste (LLW), intermediate level radioactive waste (ILW) and hazardous chemical waste (HW). Operational facilities have been commissioned for quality checking both LLW and HW. Waste quality checking has been completed on LLW packages seized from the UK waste disposal route by HMIP Inspectors. Packages have ranged in size from the 200 litre steel drum to half-height ISO freight container. Development work was continued on methods of sample extraction and radio-chemical analysis for cement encapsulated ILW in the form of magnox, graphite and stainless steel. This work was undertaken on non-radioactive simulants. (author).

17948 (DOE-HMIP-RR–92.009) **UK Natural Analogue Coordinating Group: fourth annual report.** Read, D. (Atkins (W.S.) Engineering Sciences, Epsom (United Kingdom)); Hooker, P.J. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. 1992. 29p. Contract PECD-7/9/512. (WE–91-32R.). Order Number DE92628333. Source: OSTI; NTIS (US Sales Only); INIS.

HMIP has a research programme investigating some naturally radioactive sites as geochemical analogues of radionuclide migration. All of the analogue sites under investigation, both in the U.K. and overseas, are located where elevated uranium concentrations occur naturally. Coordination of the programme is achieved through the UK Natural Analogue Co-ordinating Group (NACG) which has met three times in this reporting period. The NACG is steered by the British Geological Survey. Its purpose is to ensure that the different research projects have an integrated function aimed at increasing our understanding of natural geochemical processes. Effort is also being expended in testing research models which may be used in such assessments. (author).

17949 (DOE/LLW–65T) **Defense low-level waste management strategic plan.** EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. May 1988. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012623. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) operates one of the largest complexes for treatment and disposal of low-level radioactive waste (LLW) in the world. It has operated safely without major disruption for over forty years and continues to evolve and progress in response to new needs, new technology and an increasing environmental awareness. It is DOE's policy to maintain the same level of protection and safety for the public and for employees of DOE and its contractors as the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA). The policy is responsive to the requirements of DOE contractors who produce a wide variety of wastes at several sites around the country. This Strategic Plan supports the Defense Waste and Transportation Management Program Implementation Plan, which in turn supports the Defense Waste Management Plan submitted to Congress in June of 1983. Analysis of the issues by the DLLWMP concludes that the elements of DOE Order 5820. 2, are those elements which reduce the amount of waste requiring handling/treatment/disposal, provide for proper documentation and certification, and show compliance with public health and safety protection regulations. Those elements include: characterizing waste to permit proper segregation, treatment, storage, and disposal; minimizing the waste generated through waste generation reduction, waste segregation, and minimization; encouraging the use of waste treatment; setting performance objectives and conducting performance assessments to ensure that performance objectives are met; ensuring that disposal facilities are properly sited and that waste is properly disposed of.

17950 (DOE/LLW–147) **Evaluation of Department of Energy-held potential Greater-Than-Class C Low-Level Radioactive Waste: National Low-Level Waste Management Program: Final draft.** EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 332p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012308. Source: OSTI; NTIS; INIS; GPO Dep.

A number of commercial facilities have generated potential Greater-Than-Class C Low-Level Radioactive Waste (GTCC LLW), and through contractual arrangements with the US Department of Energy (DOE) and/or for health and safety reasons, the waste is being stored by DOE. A determination is required, considering specific circumstances under which DOE accepted the waste, whether disposal is a US Nuclear Regulatory Commission-licensed facility or by DOE in a nonlicensed facility is appropriate. This report presents the preliminary results of an assessment conducted by EG&G Idaho, Inc. legal counsel and GTCC LLW Program staff.

17951 (DOE/NE/44139–48) **Durability testing with West Valley borosilicate glass composition- Phase II: Progress in characterizing the WVDP Nuclear Waste Vitrification Process and Product by the Vitreous State Laboratory.** Macedo, P.B. (Catholic Univ. of America, Washington, DC (United States). Vitreous State Lab.); Finger, S.M.; Barkatt, A.A.; Pegg, I.L.; Feng, X.; Freeborn, W.P. Catholic Univ. of America, Washington, DC (United States). Vitreous State Lab. Jun 1988. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-81NE44139. Order Number DE92012577. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the research performed by the Catholic University of America Vitreous State Laboratory (VSL) during FY 1987 in support of the West Valley Demonstration Project (WVDP) nuclear waste vitrification process. A principal objective of this work is the optimization of the glass composition be used for the vitrification of the liquid high-level waste generated at West Valley during nuclear fuel reprocessing. This report discusses (1) the experimental investigations to optimize the reference glass composition (the current leading candidates are WVCM-50 and ATM-10) for the WVDP vitrification process; (2) the systematic experimental investigation performed to determine the effects of compositional variations in WVCM-50 and WV-205 reference glasses on their viscosity and durability (including initial results of long-term leach tests of WVCM-50 under repository conditions); (3) the development of short-time and predictive leach tests; (4) the development of a process model for the West Valley vitrification process which predicts the range of glass compositions which may be encountered during normal operations and the effects of deviations in process control parameters; and (5) the development of product models for predicting the durability and viscosity of nuclear waste glasses.

17952 (DOE/NV/10630–26) **Greater confinement disposal heterogeneity study, Nevada Test Site, Area 5, Radioactive Waste Management Site.** Davis, J.M. (Davis (J. Matthew), Socorro, NM (United States)). Reynolds Electrical and Engineering

Co., Inc., Las Vegas, NV (United States). Waste Management Dept.; Davis (J. Matthew), Socorro, NM (United States). Apr 1992. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10630. Order Number DE92011832. Source: OSTI; NTIS; INIS; GPO Dep.

A preliminary investigation of alluvial fan heterogeneity is performed. Two trench walls approximately 50 meters wide and 10 meters high are studied. The study consists of mapping the hydrogeologic units and of collecting approximately 500 air-permeability measurements. Preliminary analysis of the data indicate that the horizontal variograms conform to an exponential model with correlation lengths of 2 and 4 meters. The vertical variogram of the data from one of the trench walls is fit with an exponential-Bessel variogram with a period of approximately 2.5 meters. The vertical variogram of the data from the other trench wall exhibits insufficient resolution to fit a model. The length of parameters used in the variogram models appears to coincide with the observed lateral dimensions and vertical cyclicity of the deposits.

17953 (DOE/RL–90-08-DraftC) **Remedial investigation/feasibility study work plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington.** Westinghouse Hanford Co., Richland, WA (United States); USDOE Richland Operations Office, WA (United States). Apr 1992. 397p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012251. Source: OSTI; NTIS; INIS; GPO Dep.

Four areas of the Hanford Site (the 100, 200, 300 and 1100 Areas) have been included on the US Environmental Protection Agency's (EPA's) National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Figure 1-1 shows the location of these areas. Under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement, Ecology et al. 1990a), signed by the Washington State Department of Ecology (Ecology), EPA, and the US Department of Energy (DOE), more than 1,000 inactive waste disposal and unplanned release sites on the Hanford Site have been grouped into a number of source and groundwater operable units. These operable units contain contamination in the form of hazardous waste, radioactive/hazardous mixed waste and other CERCLA hazardous substances. Also included in the Tri-Party Agreement are 55 Resource Conservation and Recovery Act (RCRA) treatment, storage, or disposal (TSD) facilities that will be closed or permitted to operate in accordance with RCRA regulations, under the authority of Chapter 173-303 Washington Administrative Code (WAC). Some of the TSD facilities are included in the operable units. This work plant and the attached supporting project plans establish the operable unit setting and the objectives, procedures, tasks, and schedule for conducting the CERCLA remedial investigation/feasibility study (RI/FS) for the 100-BC-5 operable unit. The 100-B/C Area consists of the 100-BC-5 groundwater operable unit and four source operable units. The 100-BC-5 operable unit includes all contamination found in the aquifer soils and water beneath the 100-B/C Area. Source operable units include facilities and unplanned release sites that are potential sources of contamination.

17954 (DOE/RL–91-39) **Waste water pilot plant research, development, and demonstration permit application.** USDOE Richland Operations Office, WA (United States). Oct 1991. 324p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012592. Source: OSTI; NTIS; INIS; GPO Dep.

Waste waters have been generated as result of operations conducted at the Hanford Facility for over 40 years. These waste waters were previously discharged to cribs, ponds, or ditches. Examples of such waste waters include steam condensates and cooling waters that have not been in contact with dangerous or mixed waste and process condensates that may have been in contact with dangerous or mixed waste. Many measures have been taken to reduce the amount of contamination being discharged in these effluents. However, some of these waste waters still require additional treatment before release to the environment. Systems are being designed and built to treat these waste waters along with any future waste waters resulting from remediation activities on the Hanford Facility.

17955 (DOE/RL–91-54) **Spent fuel storage requirements, 1991–2040.** Pacific Northwest Lab., Richland, WA (United States); USDOE Richland Operations Office, WA (United States). Dec 1991. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013163. Source: OSTI; NTIS; INIS; GPO Dep.

Historical inventories of spent fuel are combined with US Department of Energy (DOE) projections of future discharges from commercial nuclear reactors in the United States to provide estimates of spent fuel storage requirements over the next 50 years, through the year 2040. The needs for storage capacity beyond that presently available in the pools are estimated. These estimates incorporate the maximum capacities within current and planned in-pool storage facilities and any planned transshipments of fuel to other reactors or facilities. Existing and future dry storage facilities are also discussed. Historical data through December 1990 are derived from the 1991 Form RW-859 data survey of nuclear utilities. Projected discharges through the end of reactor life are based on DOE estimates of future nuclear capacity, generation, and spent fuel discharges.

17956 (DOE/RL–92-2) **Hanford Federal Facility Agreement and Consent Order quarterly progress report for the period ending December 31, 1991.** USDOE Richland Operations Office, WA (United States). Feb 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012162. Source: OSTI; NTIS; GPO Dep.

This is a progress report on the waste management activities of the Hanford Reservation. It covers the disposal and processing of the single and double shell tank wastes for the time period. Also, the remedial action of the tank wastes are discussed, and the decommissioning and closures of the tanks are described for the period. This progress report gives the milestones planned for the next period.

17957 (DOE/RL–92-25) **Hanford Site annual waste reduction report.** Nichols, D.H. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); USDOE Richland Operations Office, WA (United States). Mar 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012204. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE), Richland Field Office (RL) has developed and implemented a Hanford Site Waste Minimization and Pollution Prevention Awareness Plan that provides overall guidance and direction on waste minimization and pollution prevention awareness to the four contractors who manage and operate the Hanford Site for the RL. Waste reduction at the RL will be accomplished by following a hierarchy of environmental protection practices. First, waste generation will be eliminated or minimized through source reduction. Second, potential waste materials that cannot be eliminated or minimized will be recycled (i.e., used, reused, or reclaimed). Third, all waste that is nevertheless generated will be treated to reduce volume, toxicity, or mobility before storage or disposal. The scope of this waste reduction program will include nonhazardous, hazardous, radioactive mixed, and radioactive wastes.

17958 (DOE-RW–90.089) **Product Evaluation Task Force Phase Two report for centrifuge cake.** Francis, A.J. (British Nuclear Fuels plc, Risley (United Kingdom)); Davies, A. Department of the Environment, London (United Kingdom); British Nuclear Fuels plc, Risley (United Kingdom). 1990. 35p. (ILWRP–86-P01.). Order Number DE92628323. Source: OSTI; NTIS (US Sales Only); INIS.

It has been proposed that all Intermediate Level Wastes arising at Sellafield should be encapsulated prior to ultimate disposal. The Product Evaluation Task Force (PETF) was set up to investigate possible encapsulants and to produce and adequate data base to justify the preferred matrices. Three possible types of encapsulants for Centrifuge Cake;- Inorganic cements, Polymer cements, and Polymers, are evaluated using the Kepner Tregoe decision analysis technique. This technique provides a methodology for scoring and ranking alternative options and evaluating any risks associated with an option. The analysis shows that for all four stages of waste management operations ie. Storage Transport, handling and emplacement Disposal, and Process, cement matrices are considerably superior to other potential matrices. A matrix, consisting of nine parts Blast Furnace Slag (BFS) to one part Ordinary Portland Cement (OPC) is recommended as the preferred matrix for Phase 3 studies on Centrifuge Cake. (author).

17959 (DOE-RW--90.092) **Product Evaluation Task Force Phase Two report for BWR/PWR dissolver wastes.** Francis, A.J. (British Nuclear Fuels plc, Risley (United Kingdom)). Department of the Environment, London (United Kingdom); British Nuclear Fuels plc, Risley (United Kingdom). 1990. 29p. (ILWRP--85-P12.). Order Number DE92628324. Source: OSTI; NTIS (US Sales Only); INIS.

It has been proposed that all Intermediate Level Wastes arising at Sellafield should be encapsulated prior to ultimate disposal. The Product Evaluation Task Force (PETF) was set up to investigate possible encapsulants and to produce an adequate data base to justify the preferred matrices. This report details the work carried out, under Phase 2 of the Product Evaluation Task Force programme, on BWR/PWR Dissolver Wastes. Three possible types of encapsulants for BWR/PWR Dissolver Wastes:- Inorganic cements, Polymer cements and Polymers are evaluated using the Kepner Tregoe decision analysis technique. This technique provides a methodology for scoring and ranking alternative options and evaluating any risks associated with an option. The analysis shows that for all four stages of waste management operations ie Storage, Transport, handling and emplacement, Disposal and Process, cement matrices are considerably superior to other potential matrices. A matrix, consisting of three parts Blast Furnace Slag (BFS) to one part Ordinary Portland Cement (OPC), is recommended for Phase 3 studies on BWR/PWR Dissolver Wastes. (author).

17960 (DOE/RW--0253-Rev.2) **Program cost and schedule baseline: Revision 2.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Nov 1991. 55p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The purpose of this document is to establish quantitative expressions of proposed costs and schedule to serve as a basis for measurement of the Radioactive Waste Management Program performance. It identifies the components of the Program Cost and Schedule Baseline (PCSB) that will be subject to change control by the Executive Level (Level 0) and Program (Level 1) Change Control Boards (CCBs) and establishes their baseline values. This document also details PCSB reporting, monitoring, and corrective action requirements. The Program technical baseline contained in the Waste Management System Description (WMSD) and the Waste Management System Requirements (WMSR) documents provides the technical basis for the PCSB. The PCSB establishes baseline values for the Yucca Mountain Site Characterization Project cost and schedule through submittal of the license application to the Nuclear Regulatory Commission (NRC).

17961 (DOE/RW--0293P) **DOE's Yucca Mountain studies: What are they? Why are they being done?.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Dec 1990. 28p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

This booklet is about the disposal of high-level nuclear waste in the United States. It is intended for readers who do not have a technical background. It discusses why scientists and engineers think high-level nuclear waste may be disposed of safely underground. It also describes why Yucca Mountain, Nevada, is being studied and provides basic information about those studies.

17962 (DOE/RW--0313P) **Yucca Mountain Site Characterization Project Plan.** Gertz, C.P.; Bartlett, J. USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Jan 1992. 71p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The purpose of this document is to describe the Yucca Mountain Site Characterization Project (YMP) and establish an approved YMP baseline against which overall YMP progress and management effectiveness shall be measured. For the sake of brevity, this document will be referred to as the Project Plan throughout this document. This Project Plan only addresses activities up to the submittal of the repository license application (LA) to the Nuclear Regulatory Commission (NRC). A new Project Plan will be submitted to establish the technical, cost, and schedule baselines for the final design and construction phase of development extending through the start of repository operations, assuming that the site is determined to be suitable.

17963 (DPST--70-548) **Low-temperature waste solidification.** Cordiner, J.B.; Hull, H.L. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. Jan 1971. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013120. Source: OSTI; NTIS; GPO Dep.

This study assesses the feasibility of converting aqueous radioactive wastes at the Savannah River Plant to water-free castable melts or manageable solids. A waste-melt process is proposed that incorporate desirable features from three one-step methods. The proposed scheme consists of a first-stage concentration from 30 wt % to 60 wt % solids using a bent-tube evaporator, a second-stage concentration to 90 wt % solids using a wiped-film evaporator, and a third-stage concentration to a melt using an auger-agitated calciner or an additional wiped-film evaporator. A material-balanced flowsheet was developed that begins with aqueous wastes in storage tanks and ends with the filling of steel cylinders with melt for subsequent loading on railroad cars. Recommended heat-transfer areas and energy requirements are included.

17964 (DPST--82-648) **Vitrification of incinerator Ash-2 corrosion of melter components.** Rankin, W.N. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 16 Jun 1982. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92010677. Source: OSTI; NTIS; GPO Dep.

At the request of the Waste Disposal Technology Division of Savannah River Plants the Chemical Technology Division is investigating vitrification of alpha waste incinerator (AWI) ash. This memorandum describes tests carried out to determine the corrosion rate of Monofrax K-3® and Inconel 690® at 1150°C in Frit 131 containing up to 50 wt % ash.

17965 (DPST--83-325) **The analysis of decontaminated defense waste salt supernate for I-129.** Ryan, J.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 23 Feb 1983. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013073. Source: OSTI; NTIS; GPO Dep.

A method is reported here for the analysis of I-129 in decontaminated defense waste salt solution at concentrations as low as 0.14 pCi/ml. Repeated analyses have been unable to confirm the presence of I-129 in decontaminated samples of Tank 24 supernate.

17966 (DPST--84-343) **I-129 in SRP high-level waste and saltstone.** Fowler, J.R.; Cook, J.R. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 29 Feb 1984. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013387. Source: OSTI; NTIS; GPO Dep.

Long-lived isotopes in nuclear waste can have the greatest impact on man and the environment because of the integrated dose over a long time period. Many long-lived radioactive isotopes are present in the waste at Savannah River Plant. Actinide elements make up a significant portion of these isotopes. But when the waste is incorporated into a glass waste form, the actinides are converted to chemically stable oxide species that are released at extremely low and controlled rates, even after the waste form has degraded. Because of their different chemistry, radioactive isotopes of carbon, technetium, and iodine could be released at a significantly higher rate. To establish the potential hazard from these isotopes, their concentration in waste forms for final disposal must be known. The concentrations of C-14 and T_c-99 in SRP waste were previously estimated. Additional analytical data has now been obtained for I-129 in H-Area soluble waste to estimate its concentration in SRP waste. Because of the nature of processes at SRP, most of the I-129 in the waste is in the H-Area waste tanks.

17967 (DPST–85-711) **TNX Burying Ground: Environmental information document.** Dunaway, J.K.W.; Johnson, W.F.; Kingley, L.E.; Simmons, R.V.; Bledsoe, H.W. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. Mar 1987. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013015. Source: OSTI; NTIS; INIS; GPO Dep.

The TNX Burying Ground, located within the TNX Area of the Savannah River Plant (SRP), was originally built to dispose of debris from an experimental evaporator explosion at TNX in 1953. This evaporator contained approximately 590 kg of uranyl nitrate. From 1980 to 1984, much of the waste material buried at TNX was excavated and sent to the SRP Radioactive Waste Burial Grounds for reburial. An estimated 27 kg of uranyl nitrate remains buried at TNX. The TNX Burying Ground consists of three sites known to contain waste and one site suspected of containing waste material. All four sites are located within the TNX security fenceline. Groundwater at the TNX Burying Ground was not evaluated because there are no groundwater monitoring wells installed in the immediate vicinity of this waste site. The closure options considered for the TNX Burying Ground are waste removal and closure, no waste removal and closure, and no action. The predominant pathways for human exposure to chemical and/or radioactive constituents are through surface, subsurface, and atmospheric transport. Modeling calculations were made to determine the risks to human population via these general pathways for the three postulated closure options. An ecological assessment was conducted to predict the environmental impacts on aquatic and terrestrial biota. The relative costs for each of the closure options were estimated.

17968 (DPST–85-861) **Hydroxide depletion in dilute supernates stored in waste tanks.** Hobbs, D.T. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 10 Oct 1985. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013147. Source: OSTI; NTIS; GPO Dep.

Free hydroxide ion in dilute supernates are depleted by reaction with atmospheric carbon dioxide to form bicarbonate and carbonate species and by reaction with acidic compounds formed by the radiolytic decomposition of tetraphenylborate salts. A model of the kinetics and thermodynamics of absorption of carbon dioxide in the waste tanks has been developed. Forecasts of the rate of hydroxide depletion and the requirements for sodium hydroxide to maintain technical standards have been made for the washed sludge and washed precipitate storage tanks. Hydroxide depletion is predicted to have a minimal impact on sludge processing operations. However, in-tank precipitation and downstream DWPF operations are predicted to be significantly affected by hydroxide depletion in Tank 49H. The installation of a carbon dioxide scrubber on Tank 49H may be justified in view of the decrease in alkali content and variation in the melter feed.

17969 (DPST–86-735) **Absorption of carbon dioxide in waste tanks.** Hobbs, D.T. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 21 Oct 1986. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013087. Source: OSTI; NTIS; GPO Dep.

The absorption of atmospheric carbon dioxide in eight waste tanks located in H-Area has been monitored for a period of six months. All of the tanks are continuously absorbing carbon dioxide. Approximately 75% of the carbon dioxide entering the waste tanks is absorbed when the free hydroxide concentration is above 0.1 molar. The rate of absorption decreases significantly if the free hydroxide concentration in the liquid phase falls below 0.1 molar. Based on the average instantaneous concentration of carbon dioxide in air and the fraction of carbon dioxide absorbed in Tank 42H, the rate of change in the pH and the total carbonate concentration of the washed sludge supernate has been calculated. Good agreement between experimental and calculated data was found verifying the previously reported model for calculating the rate of hydroxide depletion in dilute salt solutions.

17970 (DPST–87-596) **Absorption of carbon dioxide in waste tanks.** Hobbs, D.T. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 3 Sep 1987. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013088. Source: OSTI; NTIS; INIS; GPO Dep.

Air flow rates and carbon dioxide concentrations of air entering and exiting eight H-Area waste tanks were monitored for a period of one year. The average instanteous concentration of carbon dioxide in air is within the range reported offsite, and therefore is not affect by operation of the coal-fired power plant adjacent to the tank farm. Waste solutions in each of the tanks were observed to be continuously absorbing carbon dioxide. The rate of absorption of carbon dioxide decreased linearly with the pH of the solution. Personnel exposure associated with the routine sampling and analysis of radioactive wastes stored at SRP to determine the levels of corrosion inhibitors in solution could be reduced by monitoring the absorption of carbon dioxide and using the relationship between pH and carbon dioxide absorption to determine the free hydroxide concentration in solution.

17971 (DPSTD–87-2-TL) **Technical data summary: Plan for closure of the 643-G burial ground.** Cook, J.R. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 17 Aug 1987. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013146. Source: OSTI; NTIS; INIS; GPO Dep.

This report involves the actions of closing the 643-G burial ground which involves waste removal, stabilization, and capping. Remedial action involves the removing of the transuranic waste and closing of the grid wells. The closure cap for the burial site will consist of native soil, clay, and gravel. This will assure long-term physical and chemical stability. (MB)

17972 (EGG–10617-2127) **Yucca Mountain Biological Resources Monitoring Program: Annual report, FY91.** EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Jan 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE92011449. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is required by the Nuclear Waste Policy Act of 1982 (as amended in 1987) to study and characterize Yucca Mountain as a possible site for a geologic repository for high-level nuclear waste. During site characterization, the DOE will conduct a variety of geotechnical, geochemical, geological, and hydrological studies to determine the suitability of Yucca Mountain as a repository. To ensure that site characterization activities (SCA) do not adversely affect the Yucca Mountain area, an environmental program has been implemented to monitor and mitigate potential impacts and to ensure that activities comply with applicable environmental regulations. This report describes the activities and accomplishments during fiscal year 1991 (FY91) for six program areas within the Terrestrial Ecosystem component of the YMP environmental program. The six program areas are Site Characterization Activities Effects, Desert Tortoises, Habitat Reclamation, Monitoring and Mitigation, Radiological Monitoring, and Biological Support.

17973 (EGG-GEO–10068) **A modeling study of water flow in the vadose zone beneath the Radioactive Waste Management Complex.** Baca, R.G.; Magnuson, S.O.; Nguyen, H.D.; Martian, P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012320. Source: OSTI; NTIS; INIS; GPO Dep.

A modeling study was conducted for the purpose of gaining insight into the nature of water flow in the vadose zone beneath the Radioactive Waste Management Complex (RWMC). The modeling study focused on three specific hydrologic aspects: (1) relationship between meteorologic conditions and net infiltration, (2) water movement associated with past flooding events, and (3) estimation of water travel-times through the vadose zone. This information is necessary for understanding how contaminants may be transported through the vadose zone. Evaluations of net infiltration at the RWMC were performed by modeling the processes of precipitation, evaporation, infiltration and soil-moisture redistribution. Water flow simulations were performed for two distinct time periods, namely 1955–1964 and 1984–1990. The patterns of infiltration were calculated for both the undisturbed (or natural sediments) and the pit/

trench cover materials. Detailed simulations of the 1969 flooding of Pit 10 were performed to estimate the rate and extent of water movement through the vadose zone. Water travel-times through the vadose zone were estimated using a Monte Carlo simulation approach. The simulations accounted for variability of soil and rock hydraulic properties as well as variations in the infiltration rate.

17974 (EGG-GEO-10158) **GWSCREEN: A semi-analytical model for assessment of the groundwater pathway from surface or buried contamination: Theory and user's manual.** Rood, A.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012532. Source: OSTI; NTIS; INIS; GPO Dep.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources. The code was designed for implementation in the Track 1 and Track 2 assessment of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites identified as low probability hazard at the Idaho National Engineering Laboratory (DOE, 1991). The code calculates the limiting soil concentration such that regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: Contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation for transient mass flux input.

17975 (EGG-MS-9879) **Technical assessment of processes to enable recycling of low-level contaminated metal waste.** Reimann, G.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92010488. Source: OSTI; NTIS; GPO Dep.

Accumulations of metal waste exhibiting low levels of radioactivity (LLCMW) have become a national burden, both financially and environmentally. Much of this metal could be considered as a resource. The Department of Energy was assigned the task of inventorying and classifying LLCMW, identifying potential applications, and applying and/or developing the technology necessary to enable recycling. One application for recycled LLCMW is high-quality canisters for permanent repository storage of high-level waste (HLW). As many as 80,000 canisters will be needed by 2035. Much of the technology needed to decontaminate LLCMW has already been developed, but no integrated process has been described, even on a pilot scale, for recycling LLCMW into HLW canisters. This report reviews practices for removal of radionuclides and for producing low carbon stainless steel. Contaminants that readily form oxides may be reduced to below de minimis levels and combined with a slag. Most of the radioactivity remaining in the ingot is concentrated in the inclusions. Radionuclides that chemically resemble the elements that comprise stainless steel can not be removed effectively. Slag compositions, current melting practices, and canister fabrication techniques were reviewed.

17976 (EGG-WM-9035-Rev.1) **Modeling requirements for in situ vitrification: Revision 1.** MacKinnon, R.J.; Mecham, D.C.; Hagrman, D.L.; Johnson, R.W.; Murray, P.E.; Slater, C.E.; Marwil, E.S.; Weaver, R.A.; Argyle, M.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012322. Source: OSTI; NTIS; INIS; GPO Dep.

This document outlines the requirements for the model being developed at the INEL which will provide analytical support for the ISV technology assessment program. The model includes representations of the electric potential field, thermal transport with melting, gas and particulate release, vapor migration, off-gas combustion and process chemistry. The modeling objectives are to (1) help determine the safety of the process by assessing the air and surrounding soil radionuclide and chemical pollution hazards, the nuclear criticality hazard, and the explosion and fire hazards, (2) help determine the suitability of the ISV process for stabilizing the buried wastes involved, and (3) help design laboratory and field tests and interpret results therefrom.

17977 (EGG-WM-10109) **Full-scale tests of sulfur polymer cement and non-radioactive waste in heated and unheated prototypical containers.** Darnell, G.R.; Aldrich, W.C.; Logan, J.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012369. Source: OSTI; NTIS; GPO Dep.

Sulfur polymer cement has been demonstrated to be superior to portland cement in the stabilization of numerous troublesome low-level radioactive wastes, notably mixed waste fly ash, which contains heavy metals. EG&G Idaho, Inc. conducted full-scale, waste-stabilization tests with a mixture of sulfur polymer cement and nonradioactive incinerator ash poured over simulated steel and ash wastes. The container used to contain the simulated waste for the pour was a thin-walled, rectangular, steel container with no appendages. The variable in the tests was that one container and its contents were at 65°F (18°C) at the beginning of the pour, while the other was preheated to 275°F (135°C) and was insulated before the pour. The primary goal was to determine the procedures and equipment deemed operationally acceptable and capable of providing the best probability of passing the only remaining governmental test for sulfur polymer cement, the Nuclear Regulatory Commission's full-scale test. The secondary goal was to analyze the ability of the molten cement and ash mixture to fill different size pipes and thus eliminate voids in the resultant 24 ft^3 monolith.

17978 (EGG-WTD-9214) **Summary of in situ vitrification modeling and analysis accomplishments for fiscal year 1991.** Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013100. Source: OSTI; NTIS; GPO Dep.

The in situ vitrification (ISV) modeling activities encompass a variety of both modeling development efforts and analysis applications in support of the ISV project. The model development effort is directed toward modifying or developing a set of computer codes to simulate the ISV process. These codes are used to perform safety and environmental hazards analyses, assist in experimental test planning and design, assist in equipment design and development of operating procedures, and provide enhanced understanding of the ISV process. This report presents a summary description of the accomplishments in Fiscal Year 1991 for both the model development and analysis areas. Brief descriptions of the models that were developed and the more important conclusions from the analytical studies are presented.

17979 (EGG-WTD-9432-Vol.1-Rev.1) **Use of noninvasive geophysical techniques for the In Situ Vitrification Program: Volume 1, Literature review: Revision 1.** Josten, N.E.; Marts, S.T.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012568. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is a waste pit remediation technology that can potentially eliminate the need for pit excavation. The ISV program at the Idaho National Engineering Laboratory (INEL) funded this study to evaluate geophysical techniques that might be useful for performing detailed screening of the materials, soil conditions, and local geology of waste pits targeted for remediation. The evaluation focuses on a specific set of characterization objectives developed by ISV engineers. The objectives are based on their assessment of safety, environmental, and cost efficiency issues associated with the ISV process. A literature review of geophysical case histories was conducted and a geophysical survey was performed at the INEL simulated waste pit so that the evaluation could be based on demonstrable results.

17980 (EGG-WTD-9432-Vol.2) **Use of noninvasive geophysical techniques for the In Situ Vitrification Program: Volume 2, Demonstration at the simulated waste pit.** Marts, S.T.; Josten, N.E.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012569. Source: OSTI; NTIS; GPO Dep.

This document is the second volume of a three volume report to evaluate geophysical methods for use in the detailed characterization of waste pits. The In Situ Vitrification (ISV) Program funded the study to support the ISV remediation technology being developed at the Idaho National Engineering Laboratory (INEL). The ISV Program is considering geophysical waste characterization as a means to enhance the efficiency of the ISV process. Field tests were conducted to demonstrate and evaluate the application of magnetic, electromagnetic induction, and ground penetrating radar methods to waste site characterization. The primary objective was to investigate the ability of these noninvasive geophysical methods to locate and identify buried waste materials under conditions representative of the INEL Subsurface Disposal Area (SDA). The tests were conducted at an simulated waste pit designed to represent conditions at the SDA.

17981 (EGG-WTD-9432-Vol.3) **Use of noninvasive geophysical techniques for the in situ vitrification program: Volume 3, Discussion and recommendations.** Josten, N.E.; Marts, S.T.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012601. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is a waste pit remediation technology that can potentially eliminate the need for pit excavation. The ISV program at the Idaho National Engineering Laboratory (INEL) funded this study to evaluate geophysical techniques that might be useful for performing detailed screening of the materials, soil conditions, and local geology of waste pits targeted for remediation. The evaluation focusses on a specific set of characterization objectives developed by ISV engineers. The objectives are based on their assessment of safety, environmental, and cost efficiency issues associated with the ISV process. A literature review of geophysical case histories was conducted and a geophysical survey was performed at the INEL simulated waste pit so that the evaluation could be based on demonstrable results. The literature review shows that all the ISV objectives are theoretically achievable because they involve physical properties (such as electrical conductivity, density, or magnetization) that can be sensed by geophysical instruments. However, most of the ISV objectives require substantially higher resolution than is achieved in typical waste site investigations, or than has been demonstrated by researches using state-of-the-art techniques. The survey at the INEL simulated waste pit yielded useful, qualitative information on subsurface materials and boundaries; but quantitative information, such as depth, size, or composition of buried materials, was subject to significant uncertainty. For ISV, the usefulness of geophysical characterization depends both on the capabilities of geophysical methods and on an assessment of the amount of uncertainty that is acceptable. Based on a preliminary assessment of these factors, the location of trench boundaries and detection of massive metallic objects are the important achievable objectives using current technology.

17982 (EGG-WTD-9520) **Test plan for ISV laboratory-pyrolysis testing.** McAtee, R.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012515. Source: OSTI; NTIS; GPO Dep.

The objective of the laboratory-pyrolysis studies is to obtain information on the high temperature (< 1200°C) degradation and alteration of organic chemicals and materials similar to those found in the Radioactive Waste Management Complex, Pit 9. This test plan describes experimental procedures, sampling and analysis strategy, sampling procedures, sample control, and document management. It addresses safety issues in the experimental apparatus and procedures, personal training, and hazardous waste disposal. Finally, it describes the data quality objectives using the EPA tiered approach to treatability studies to define where research/scoping tests fit into these studies and the EPA analytical levels required for the tests.

17983 (EGG-WTD-9594-Vol.3) **Preliminary systems design study assessment report: Volume 3, Process in-place/leave in-place concepts.** Mayberry, J.L. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012533. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept.

17984 (EGG-WTD-9594-Vol.5) **Preliminary Systems Design Study assessment report: Volume 5, Land disposal compliance and hydrogen generation restricted concepts.** Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012534. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept.

17985 (EGG-WTD-9594-Vol.6) **Preliminary Systems Design Study assessment report: Volume 6, Waste Isolation Pilot Plant and transportation package acceptable concepts.** Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012535. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques for the remediation of hazardous and transuranic waste stored at Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept. This volume contains introduction section containing a brief SDS background and lists the general assumptions and considerations used during the development of the system concepts. The introduction section is followed by sections describing two system concepts that produce a waste form in compliance with the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC) and transportation package (TRAMPAC) requirements. This system concept category is referred to as Waste Form 4, "WIPP and TRAMPAC Acceptable." The following two system concepts are under this category: Sort, Treat, and Repackage System (4-BE-2); Volume Reduction and Packaging System (4-BE-4).

17986 (EGG-WTD-9594-Vol.7) **Preliminary systems design study assessment report: Volume 7, Subsystem concepts.** Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012536. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each. This volume contains the descriptions and other relevant information of the four subsystems required for most of the ex situ processing systems. This volume covers the metal decontamination and sizing subsystem, soils processing subsystem, low-level waste subsystem, and retrieval subsystem.

17987 (EGG-WTD-9594-Vol.8) **Preliminary Systems Design Study assessment report: Volume 8, Appendixes.** Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012537. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept. This volume of the Systems Design Study contain four Appendixes that were part of the study. Appendix A is an EG&G Idaho, Inc., report that represents a review and compilation of previous reports describing the wastes and quantities disposed in the Subsurface Disposal Area of the Idaho National Engineering Laboratory. Appendix B contains the process flowsheets considered in this study, but not selected for detailed analysis. Appendix C is a historical tabulation of radioactive waste incinerators. Appendix D lists Department of Energy facilities where cementation stabilization systems have been used.

17988 (EGG-WTD-9752) **Buried Waste Integrated Demonstration: Selection of potential demonstration locations.** Arrenholz, D.A.; Knight, J.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012224. Source: OSTI; NTIS; INIS; GPO Dep.

The first step towards identifying primary Buried Waste Integrated Demonstration locations is the selection of potential demonstration sites within the Subsurface Disposal Area. The sites selected are Pits 4, 5, 6, and 9, containing transuranic waste of Rocky Flats origin, the Acid Pit, and Pad A. The criteria and methodology for selection of these sites, as well as a description of the wastes present in each area, are included in this report. At a later date, technology-specific demonstration locations will be selected from these six potential sites. The selected locations will be used as necessary to demonstrate technologies whose potential abilities may be optimal on waste forms present at these identified locations.

17989 (EGG-WTD-9800) **Buried Waste Integrated Demonstration Program Technology Test Plan Guidance.** Rehwaldt, J.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012524. Source: OSTI; NTIS; INIS; GPO Dep.

The Technology Test Plan Guidance provides instructions for principal investigators preparing test plans to demonstrate technologies supported by the Buried Waste Integrated Demonstration Program.

17990 (EGG-WTD-9868) **Product evaluation of in situ vitrification engineering, Test 4.** Loehr, C.A.; Weidner, J.R.; Bates, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012310. Source: OSTI; NTIS; INIS; GPO Dep.

This report is one of several that evaluates the In Situ Vitrification (ISV) Engineering-Scale Test 4 (ES-4). This document describes the chemical and physical composition, microstructure, and leaching characteristics of ES-4 product samples; these data provide insight into the expected performance of a vitrified product in an ISV buried waste application similar to that studied in ES-4.

17991 (EGG-WTD-9872) **Parametric melting studies for in situ vitrification.** Fryer, M.O.; Hawkes, G.L.; Murray, P.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012526. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a series of simulation studies which examine heat conduction and electric heating during in situ vitrification (ISV). The simulation studies determine the effects of soil parameter changes on the ISV process. Changes in heat capacity, thermal conductivity and electrical conductivity are considered. The results of these studies provide a basis for experimental measurement accuracy requirements.

17992 (EGG-WTD-9901) **Physical and chemical properties of the products of in situ vitrification engineering tests 5, 6, and 7.** Loehr, C.A.; Weidner, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012371. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is an in situ thermal treatment process that is being investigated by the Idaho National Engineering Laboratory (INEL) for application to buried waste sites. ISV is a thermal treatment process that converts contaminated soil into a chemically inert and stable glass and crystalline product. The INEL is evaluating whether the treatment process is a viable one for remediating a buried mixed transuranic waste site at the INEL Subsurface Disposal Area (SDA). The SDA is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. As part of the INEL investigation, a series of tests have been performed that address issues associated with vitrification of buried waste. Two pilot ISV tests and four tests at laboratory scale, formerly called engineering scale, were performed in 1990 to support the INEL investigation. The chemical composition and leaching of the produce glass is described.

17993 (EGG-WTD-9911) **Melter development needs assessment for RWMC buried wastes.** Donaldson, A.D.; Carpenedo, R.J.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012365. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a survey and initial assessment of the existing state-of-the-art melter technology necessary to thermally treat (stabilize) buried TRU waste, by producing a highly leach resistant glass/ceramic waste form suitable for final disposal. Buried mixed transuranic (TRU) waste at the Idaho National Engineering Laboratory (INEL) represents an environmental hazard requiring remediation. The Environmental Protection Agency (EPA) placed the INEL on the National Priorities List in 1989. Remediation of the buried TRU-contaminated waste via the CERCLA decision process is required to remove INEL from the National Priorities List. A Waste Technology Development (WTD) Preliminary Systems Design and Thermal Technologies Screening Study identified joule-heated and plasma-heated melters as the most probable thermal systems technologies capable of melting the INEL soil and waste to produce the desired final waste form [Iron-Enriched Basalt (IEB) glass/ceramic]. The work reported herein then surveys the state of existing melter technology and assesses it within the context of processing INEL buried TRU wastes and contaminated soils. Necessary technology development work is recommended.

17994 (EGG-WTD-9923) **Technology evaluation report for the Buried Waste Robotics Program Subsurface Mapping Project.** Griebenow, B.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012523. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a summary of the work performed in support of the Buried Waste Robotics Program Subsurface Mapping Project. The project objective was to demonstrate the feasibility of remotely characterizing buried waste sites. To fulfill this objective, a remotely-operated vehicle, equipped with several sensors, was deployed at the Idaho National Engineering Laboratory. Descriptions of the equipment and areas involved in the project are included in this report. Additionally, this document provides data that was obtained during characterization operations at the Cold Test Pit and the Subsurface Disposal Area, both at the Idaho National Engineering Laboratory's Radioactive Waste Management Complex, and at the Idaho Chemical Processing Plant. The knowledge gained from the experience, that can be applied to the next generation remote-characterization system, is extensive and is presented in this report.

17995 (EGG-WTD-9925) **Plasma treatment of INEL soil contaminated with heavy metals.** Detering, B.A.; Batdorf, J.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012372. Source: OSTI; NTIS; INIS; GPO Dep.

INEL soil spiked with inorganic salts of chromium, lead, mercury, silver, and zinc was melted in a 150 kW plasma furnace to produce a glassy slag product. This glassy slag is an environmentally safe waste form. In order to reduce the melting temperature of the soil, sodium carbonate was added to half of the test batches. Random sample from each batch of glassy slag product were analyzed by an independent laboratory for total metals concentration and leachability of metals via the Environmental Protection Agency (EPA) toxicity characterization leaching procedure (RCLP) tests. These tests showed the residual metals were very tightly bound to the slag matrix and were within EPA TCLP limits under these test conditions. Additionally, scanning electron microscopy (SEM) and emissions dispersive spectroscopy (EDS) analysis of the vitrified soil also confirmed that the added metals present in the vitrified soil were totally contained in the crystalline phase as distinct oxide crystallites.

17996 (EGG-WTD-9985-Vol.1) **Technical issues associated with in situ vitrification of the INEL Subsurface Disposal Area: Volume 1, A systematic approach for identification, prioritization, and closure of technical issues.** Stoots, C.M.; Bates, S.O.; Callow, R.A.; Campbell, K.A.; Farnsworth, R.K.; Gratson, G.K.; McKellar, M.G.; Nickelson, D.F.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012513. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as an alternative technology for remediation of the Acid Pit and Transuranic Pits and Trenches (TRU-PTs) that are present at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). However, a number of technical issues exist that must be resolved before ISV can be considered applicable to these waste sites. To assist in the ISV technology evaluation, an ISV Steering Committee was formed to identify, prioritize, and develop closure roadmaps for technical issues associated with ISV application at the INEL SDA. The activities of the ISV Steering Committee are summarized in three volumes of this report. This document, Volume 1, identifies the systematic approach used to identify and prioritize the ISV technical issues, and briefly discusses the methodology that will be employed to resolve these issues.

17997 (EGG-WTD-9985-Vol.2) **Technical issues associated with in situ vitrification of the INEL Subsurface Disposal Area: Volume 2, Application of technical issues to the Acid Pit.** Stoots, C.M.; Bates, S.O.; Callow, R.A.; Campbell, K.A.; Farnsworth, R.K.; Gratson, G.K.; McKellar, M.G.; Nickelson, D.F.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012514. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as an alternative technology for remediation of the Acid Pit and Transuranic Pits and Trenches (TRU-PTs) that are present at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). However, a number of technical issues exist that must be resolved before ISV can be considered applicable to these waste sites. To assist in the ISV technology evaluation, an ISV Steering Committee was formed to identify, prioritize, and develop closure roadmaps for technical issues associated with ISV application at the INEL SDA. The activities of the ISV Steering Committee are summarized in three volumes of this report. Volume 1 identifies the systematic approach used to identify and prioritize the ISV technical issues, and briefly discusses the methodology that will be employed to resolve these issues. This document Volume 2 and Volume 3 discusses each technical issue in greater detail and suggest specific closure roadmaps to be used in resolving technical issues associated with ISV at the SDA Acid Pit and TRU-PTs, respectively.

17998 (EGG-WTD-9993) **Energy and costs scoping study for plasma pyrolysis thermal processing system.** Sherick, K.E.; Findley, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012359. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study was to provide information in support of an investigation of thermal technologies as possible treatment process for buried wastes at the INEL. Material and energy balances and a cost estimate were generated for a representative plasma torch-based thermal waste treatment system operating in a pyrolysis mode. Two waste streams were selected which are representative of INEL buried wastes, large in volume, and difficult to treat by other technologies. These streams were a solidified nitrate sludge waste stream and a waste/soil mix of other buried waste components. The treatment scheme selected includes a main plasma chamber operating under pyrolyzing conditions; a plasma afterburner to provide additional residence time at high temperature to ensure complete destruction of hazardous organics; an off-gas treatment system; and a incinerator and stack to oxidize carbon monoxide to carbon dioxide and vent the clean, oxidized gases to atmosphere. The material balances generated provide materials flow and equipment duty information of sufficient accuracy to generate initial rough-order-of-magnitude (ROM) system capital and operating cost estimates for a representative plasma thermal processing system.

17999 (EGG-WTD-10033) **Idaho National Engineering Laboratory In Situ Vitrification Project FY-91 progress report.** Gardner, B.M.; Arrenholz, D.A.; Bates, S.O.; Farnsworth, R.K.; Nickelson, D.F.; Callow, R.A.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012368. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to present an overview conducted under the In Situ Vitrification (ISV) Project at the Idaho National Engineering Laboratory (INEL) during the 1991 Fiscal Year. The report will concentrate on describing the activities being conducted by the ISV project at the INEL and the advances made in this project at the INEL and the advances made in this project during FY 1991. Because detailed descriptions of the ISV process are available elsewhere (Arrenholz et al. 1990, Callow et al. 1991a), this discussion will not be repeated here.

18000 (EGG-WTD-10035) **Assessment of incineration and melting treatment technologies for RWMC buried waste.** Geimer, R. (Science Applications International Corp., Idaho Falls, ID (United States)); Hertzler, T.; Gillins, R.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States); Science Applications International Corp., Idaho Falls, ID (United States). Feb 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012522. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an identification, description, and ranking evaluation of the available thermal treatment technologies potentially capable of treating the Idaho National Engineering Laboratory Radioactive Waste Management Complex (RWMC) buried mixed waste. The ranking evaluation focused separately upon incinerators for treatment of combustible wastes and melters for noncombustible wastes. The highest rank incinerators are rotary kilns and controlled air furnaces, while the highest rank melters are the hearth configuration plasma torch, graphite electrode arc, and joule-heated melters. 4 refs.

18001 (EGG-WTD-10036) **Assessment of selected furnace technologies for RWMC waste.** Batdorf, J. (Science Applications International Corp., Idaho Falls, ID (United States)); Gillins, R.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012512. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a description and initial evaluation of five selected thermal treatment (furnace) technologies, in support of earlier thermal technologies scoping work for application to the Idaho National Engineering Laboratory Radioactive Waste Management Complex (RWMC) buried wastes. The cyclone furnace, molten salt processor, microwave melter, ausmelt (fuel fired lance) furnace, and molten metal processor technologies are evaluated. A system description and brief development history are provided. The state of development of each technology is assessed, relative to treatment of RWMC buried waste.

18002 (EGG-WTD-10056) **Summary of INEL research on the iron-enriched basalt waste form.** Reimann, G.A.; Grandy, J.D.; Eddy, T.L.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012510. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the knowledge base on the iron-enriched basalt (IEB) waste form developed at the Idaho National Engineering Laboratory (INEL) during 1979–1982. The results presented discuss the applicability of IEB in converting retrieved transuranic (TRU) waste from INEL's Radioactive Waste Management Complex (RWMC) into a vitreous/ceramic (glassy/rock) stable waste form suitable for permanent disposal in an appropriate repository, such as the Waste Isolation Pilot Plant (WIPP) in New Mexico. Borosilicate glass (BSG), the approved high-level waste form, appears unsuited for this application. Melting the average waste-soil mix from the RWMC produces the IEB composition and attempting to convert IEB to the BSG composition would require additions of substantial B_20_3, Na, and SiO_2 (glass frit). IEB requires processing temperatures of 1400 to 1600°C, depending upon the waste composition. Production of the IEB waste form, using Joule heated melters, has proved difficult in the past because of electrode and refractory corrosion problems associated with the high temperature melts. Higher temperature electric melters (arc and plasma) are available to produce this final waste form. Past research focused on extensive slag property measurements, waste form leachability tests, mechanical, composition, and microstructure evaluations, as well as a host of experiments to improve production of the waste form. Past INEL studies indicated that the IEB glass-ceramic is a material that will accommodate and stabilize a wide range of heterogeneous waste materials, including long lived radionuclides and scrap metals, while maintaining a superior level of chemical and physical performance characteristics. Controlled cooling of the molten IEB and subsequent heat treatment will produce a glass-ceramic waste form with superior leach resistance.

18003 (EGG-WTD-10081) **Buried waste integrated demonstration configuration management plan.** Cannon, P.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012367. Source: OSTI; NTIS; GPO Dep.

This document defines plans for the configuration management requirements for the Buried Waste Integrated Demonstration (BWID) Program. Since BWID is managed programmatically by the Waste Technology Development Department (WTDD), WTDD Program Directive (PD) 1.5 (Document Preparation, Review, Approval, Publication, Management and Change Control) is to be followed for all internal EG&G Idaho, Inc., BWID programmatic documentation. BWID documentation generated by organizations external to EG&G Idaho is not covered by this revision of the Configuration Management Plan (CMP), but will be addressed in subsequent revisions.

18004 (EGG-WTD-10129) **Release model for in situ vitrification large-field test off-gas treatment system.** Pafford, D.J.; Tung, V.X. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012373. Source: OSTI; NTIS; GPO Dep.

A conceptual model for the vapor and aerosol transport and deposition in the in situ vitrification large-field test off-gas system (OGS) has been developed. This model can be used to predict the emissions from the OGS under normal and off-normal conditions. Results generated by the model can be used to evaluate design and/or procedural modifications, define tests, and predict results. The OGS vapor and aerosol transport and deposition is modeled using the PULSE/MOD-ISV/VER 1.0.0 developmental computer code. Input data requirements for this code include the specific geometries of the OGS components; the composition, rate, and temperature of the vapors and aerosols entering the OGS; and the OGS component surface temperatures or heat fluxes. Currently, not all of these model inputs are available. Therefore, conceptual input parameters are developed. Using this input data, preliminary calculations with the code have been performed. These calculations include a demonstration that the code predicts convergent results, a comparison of predicted results with performance data for one of the OGS components, and a preliminary sensitivity study of the complete model.

18005 (FEMP-2260) **CERCLA integration with site operations: The Fernald experience.** Kolthoff, K.R.; Shirley, R.S.; Varchol, B.D. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. (CONF-920466-3: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92011391. Source: OSTI; NTIS; INIS; GPO Dep.

A major transition in the Fernald Environmental Management Project (FEMP) site mission has occurred over the past few years. The production capabilities formally provided by the FEMP are being transferred to private industry through a vendor qualification program. Environmental compliance and site cleanup are now the primary focus. In line with this program, the production of uranium products at the site was suspended in July 1989 in order to concentrate resources on the environmental mission. Formal termination of the FEMP production mission was accomplished on June 19, 1991. Environmental issues such as stored inventories of process residues materials and equipment are being addressed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The diversity of these hazards complicates the strategic planning for an integrated site cleanup program. The FEMP is one of the first Department of Energy (DOE) facilities to transition from an active production mission guided by Defense Programs (DP) to an environmental mission guided by Environmental Management (EM) under Leo Duffy. Westinghouse Environmental Management Company of Ohio (WEMCO) has been charged with integrating al site activities to carry out the cleanup. A new management structure has been formulated and an integration approach initiated. Analyses are under way to evaluate all site activities such as waste management, safe shutdown, product material disposition and routine environmental monitoring in view of CERCLA requirements. This paper discusses the programmatic approach which is being implemented to ensure activities such as waste management, site utility and support services, health and safety programs, and Resource Conservation and Recovery Act (RCRA) programs are being integrated with the primary site objectives of CERCLA remediation.

18006 (FEMP-2262) **Silos 1 and 2 removal action: Implementation of a non-time critical removal action at a federal facility.** Nixon, D.A. (Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project); Heckendorn, L.A.; Allen, R.B. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC05-86OR21600. (CONF-920466–2: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92011392. Source: OSTI; NTIS; INIS; GPO Dep.

One of the Remedial Investigation/Feasibility Study (RI/FS) identified operable units, Operable Unit 4, at the Fernald Environmental Management Project (FEMP) includes the two K-65 Silos (Silos 1 and 2), the metal oxide silo (Silo 3), the unused Silo 4 and the potentially contaminated soils surrounding the waste storage sites. It was determined by the Department of Energy (DOE), as the lead agency at the FEMP, that a non-time critical removal action was necessary for Silos 1 and 2. The scope of this removal action can be broadly defined as "reducing the chronic radon emissions and the control of potential releases of residues from Silos 1 and 2." The removal action was conducted pursuant to the Consent Agreement Under CERCLA 120 and 106 (a) between the DOE and United States Environmental Protection Agency (US EPA) as Removal Number 4: Silos 1 and 2. An Engineering Evaluation/Cost Analysis (EE/CA) for the K-65 Silos Removal Action was prepared to evaluate the removal action alternatives, using the preliminary RI/FS data, to support the selection of the preferred alternative. The objective of this removal action as stated in the EE/CA were as follows: To reduce routine emissions of radon from the K-65 Silos to maximum extent practical within the context of the removal action. To decrease, mitigate, or otherwise control the threat of K-65 residues released in significant quantities as a result of dome failure caused by a tornado. As selected by the K-65 Silos EE/CA, the alternative implemented for this removal action consisted of covering the K-65 residues with a gas barrier material, a bentonite slurry, that is retarding the emanation of radon gas into the space between the residues and the silos domes.

18007 (FEMP–2264) **Vitrification and solidification remedial treatment and disposal costs.** Gimpel, R.F. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. 12 Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. (CONF-9203112–1: Westinghouse GOCO symposium, Richland, WA (United States), 23-25 Mar 1992). Order Number DE92011148. Source: OSTI; NTIS; GPO Dep.

Solidification (making concrete) and vitrification (making glass) are frequently the treatment methods recommended for treating inorganic or radioactive wastes. Solidification is generally perceived as the most economical treatment method. Whereas, vitrification is considered (by many) as the most effective of all treatment methods. Unfortunately, vitrification has acquired the stigma that it is too expensive to receive further consideration as an alternative to solidification in high volume treatment applications. Ironically, economic studies, as presented in this paper, show that vitrification may be more competitive in some high volume applications. Ex-situ solidification and vitrification are the competing methods for treating in excess of 450,000 m^3 of low-level radioactive and mixed waste at the Fernald Environmental Management Project (FEMP or simply, Fernald) located near Cincinnati, Ohio. This paper summarizes a detailed study done to: compare the economics of the solidification and vitrification processes, determine if the stigma assigned to vitrification is warranted and, determine if investing millions of dollars into vitrification development, along with solidification development, at the Fernald is warranted.

18008 (GSF–32/91) **High-frequency microseismicity in the rock salt of the Asse mine around the 945 m level.** Yaramanci, U. (GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Braunschweig (Germany). Inst. fuer Tieflagerung). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Nov 1991. 121p. (In German). Contract BMFT KWA 5603A. (GSF-TL–24/91). Order Number DE92516785. Source: OSTI; NTIS (US Sales Only); INIS.

3407 events were registrated up to a distance of 300 m during the period from 12.10.1989 to 31.12.1990, of which 385 could be precisely located. Activities were determined in areas surrounding the dam construction traversal drifts and boreholes at the 875 m level, near the large cavern at 975 m depth, in drifts and caverns above the 875 m level and in the vicinity of the rock salt/carnallitite transition zone to the south-east of the 875 m level. Energies and source parameters were calculated by means of spectres. Energy variations range from 10 J to 10^{-4} J, the source radii from 3.5 m to 0.2 m, the source dislocations from 10^{-6} m to 10^{-8} m, and the stress drops from 10^5 Pa to 0.06 10^5 Pa. Magnitude and type of events observed are usual for mines. The microseismic activity provides an insight into the origin as well as changes of stress and rock mechanical material properties. (orig./HP).

18009 (GSF-HY–1/91, pp. 68-72) **Investigation of radionuclide migration using site-specific specimens taken from shafts of the Gorleben salt mine.** Klotz, D. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The studies have been performed for the project for investigation of the radionuclide migration in the cap rock of the Gorleben repository for radio-active waste. The paper reports parameter studies describing the radionuclide migration. The dynamic sorption behaviour of 36 Cl^-, 131 J, 45 Ca^{2+}, 85 Sr^{2+}, and 134 Cs^+ have been determined. (DG).

18010 (GSF-HY–1/91, pp. 73-78) **Hydrogeological studies at the Asse salt mine. Tracer experiments in the cap rock of the salt anticline of the Asse mine.** Batsche, H.; Behrens, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

Four experiments with ground-water labelling in the Asse cap rock have been performed with the tracers uranin 20, uranin 25, eosin 40, and pyranin 30. Results obtained so far do not reveal any penetration of tracers at the experimental sites, but it is expected that the long-term experiment will yield data on the dilution velocities, giving information on the flowage of ground waters. (DG).

18011 (GSF-HY–1/91, pp. 79-80) **Isotope hydrology experiments.** Batsche, H.; Trimborn, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

From the concentrations of H_2 and O_{18} in the examined ground waters in the Lower Muschelkalk of the SW flank of the Asse mine it can be inferred that the flow field of the ground water with the isotopic composition of the recent precipitations has an effect down to a depth of only 611 to 744 m. (DG).

18012 (GSF-HY–1/91, pp. 81) **Dissolved gases in the water of the deep bore hole R 6.** Batsche, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

Gas released from a deep-well ground water due to pressure relief is characterized in its composition by N_2 being the main constituent, the constituents H_2S and CH_4, and the occurrence of higher hydrocarbons. Except for the H_2S, the composition of the released gases is similar to that of the gas dissolved in the brines at the salt wash surface of the Asse mine. (DG).

18013 (HAN–29064) **Minutes of joint meeting with United States Geological Survey, Atomic Energy Commission, and General Electric to discuss waste disposal problems, October 27, 1949.** Hanford Works, Richland, WA (United States). 28 Nov 1949. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011859. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a letter of transmittal which describes the waste disposal problem at the Hanford Site. These disposal problems were discussed with the United States Geologic Survey, Atomic Energy Commission, and General Electric on October 27, 1949. Conclusions from this meeting is the main text of this letter.

18014 (HAN–41693) **Tritium wastes.** Hanford Works, Richland, WA (United States). 1 Nov 1951. 1p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011861. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a memorandum from the Hanford Operations Office about the possibility of tritium wastes escaping into the atmosphere. The waste which is disposed of in burial grounds eventually migrates to the Columbia River where it evaporates into the atmosphere. Also included in this memo is a statement of an error in the units of some data compiled for the monitoring of the tritium wastes. (MB)

18015 (INEL/MISC--91107) **DOE LLW classification rationale.** Flores, A.Y. Idaho National Engineering Lab., Idaho Falls, ID (United States). 16 Sep 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012222. Source: OSTI; NTIS; INIS; GPO Dep.

This report was about the rationale which the US Department of Energy had with low-level radioactive waste (LLW) classification. It is based on the Nuclear Regulatory Commission's classification system. DOE site operators met to review the qualifications and characteristics of the classification systems. They evaluated performance objectives, developed waste classification tables, and compiled dose limits on the waste. A goal of the LLW classification system was to allow each disposal site the freedom to develop limits to radionuclide inventories and concentrations according to its own site-specific characteristics. This goal was achieved with the adoption of a performance objectives system based on a performance assessment, with site-specific environmental conditions and engineered disposal systems.

18016 (INFO--0208) **Estimation of activity in waste packages: A survey of methods.** Scott, C.K. (Atlantic Nuclear Services Ltd., Fredericton, NB (Canada)); Friedman, S.T. Atomic Energy Control Board, Ottawa, ON (Canada). 15 Sep 1986. 57p. Order Number DE92628325. Source: OSTI; NTIS (US Sales Only); INIS.

Nine nuclear facilities in Canada and the United States were surveyed by telephone to determine their current methods for assaying the radionuclide content of packages of solid low-level radioactive wastes. Also, the international literature was surveyed to determine current and proposed methods for estimating the radionuclide content of waste packages. A bibliography of relevant reports and articles has been prepared. Two assay methods are reviewed: the method of assigning a gross Curie content based on an external dose measurement; and, the method of estimating the Curie content of specific radionuclides based upon external dose measurements combined with waste stream characterization or gamma spectrum analysis.

18017 (INIS-GB--434) **Annual report on radioactive discharges and monitoring of the environment 1990. V. 2: Certificates of authorisation and environmental monitoring programmes.** British Nuclear Fuels plc, Risley (United Kingdom). Health and Safety Directorate. 1991 101p. Order Number DE92627848. Source: OSTI; NTIS (US Sales Only); INIS.

This Annual Report supplements the Health and Safety Annual Report of British Nuclear Fuels plc by providing more detailed information on radioactive discharges, monitoring of the environment and critical group doses. This report has been sub-divided into two complementary parts. Volume I includes annual data for each of the Company sites on radioactive discharges into the environment and the associated environmental monitoring programmes. The sites involved are: Sellafield where the main activities are irradiated nuclear fuel reprocessing and the Calder Hall nuclear station; the Drigg radioactive waste storage and disposal site; the Chapelcross nuclear power station; Springfields Works which manufactures nuclear fuels; Capenhurst Works where uranium isotopic enrichment plants are operated. Volume II reproduces the Certificates of Authorisation under which the Company operates and the statutory environmental monitoring programmes which relate to them. (author).

18018 (INIS-mf--13151) **Elaboration of y-fanjasite catalysts containing radioactive elements such as uranyl ion in order to obtain aromatic solvents and heavy amines.** Nibou, D. Centre de Developpement des Materiaux, Algiers (Algeria). Lab. d'Analyse. Jun 1990. 183p. (In French). Order Number DE92627041. Source: OSTI; NTIS (US Sales Only); INIS.

The present work has shown the possibility of ammonia alkylation by n-octanol-l in gaseous phase, in presence of zeolitic catalysts. These catalysts are Y faujasitic types being used in waste water demineralization containing radioactive elements such as uranyl ion. This ion gives to the Y faujasite similar activity and selectivity as those of catalysts containing rare earths or transition metals. Toluene disproportionation has permitted to test beforehand catalysts destined to ammonia alkylation and to compare their mechanism. We have also proved the possibility to produce heavy amines such as tertiary amines which are used as uranium extractant agent. Some zeolites such as ZSM-5, beta, X, A, analcime, HS and Y faujasite type are prepared by hydrothermal synthesis method and characterized by some analysis techniques.

18019 (INIS-mf--13183, pp. 39) **The CNS approach to the specification of reference levels for the acceptance of alpha-bearing radwaste for shallow land disposal.** Mare, E (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132--: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ALPHA-BEARING WASTES/ground disposal; ALPHA-BEARING WASTES/radiation protection; ACTINIUM; HUMAN INTRUSION; MINING; RADIOACTIVITY; RADIOISOTOPES; SOUTH AFRICAN ORGANIZATIONS; SPECIFICATIONS; THORIUM; URANIUM

18020 (Juel--2481) **Pressure distribution on the surface of waste forms stored and completely embedded in salt gruss according to the borehole technology.** Block, F.R. (Technische Hochschule Aachen (Germany). Inst. fuer Eisenhuettenkunde); Feuser, W. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie. May 1991. 74p. (In German). Contract BMFT KWA 5302B6. Order Number DE92511180. Source: OSTI; NTIS (US Sales Only); INIS.

To finally dispose of heat developing middle active wastes, it is intended to store the waste forms in unlined boreholes situated in underground rock salt formations. The wastes consist of LWR fuel cans, structural parts and feed sludge as well as of spent high-temperature fuel elements. The development of appropriate methods for final disposal in salt, and their testing in the Asse salt mine, provides for a concept of semi-hydrostatic storage, with the backfill of the borehole consisting of waste forms and salt gruss. The backfilling on the borehole is dealt with under a continuum theory. (DG).

18021 (KFK--4945) **Separation of actinides and long-lived fission products from high-level radioactive wastes (a review).** Kolarik, Z. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Heisse Chemie. Nov 1991. 80p. Order Number DE92511440. Source: OSTI; NTIS (US Sales Only); INIS.

The management of high-level radioactive wastes is facilitated, if long-lived and radiotoxic actinides and fission products are separated before the final disposal. Especially important is the separation of americium, curium, plutonium, neptunium, strontium, cesium and technetium. The separated nuclides can be deposited separately from the bulk of the high-level waste, but their transmutation to short-lived nuclides is a muchmore favourable option. This report reviews the chemistry of the separation of actinides and fission products from radioactive wastes. The composition, nature and conditioning of the wastes are described. The main attention is paid to the solvent extraction chemistry of the elements and to the application of solvent extraction in unit operations of potential partitioning processes. Also reviewed is the behaviour of the elements in the ion exchange chromatography, precipitation, electrolysis from aqueous solutions and melts, and the distribution between molten salts and metals. Flowsheets of selected partitioning processes are shown and general aspects of the waste partitioning are shortly discussed. (orig.).

18022 (LA--11978-MS) **Evaluation of extractants and chelating resins in polishing actinide-contaminated waste streams.** Schreiber, S.B.; Dunn, S.L.; Yarbro, S.L. Los Alamos National

Lab., NM (United States). Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011491. Source: OSTI; NTIS; GPO Dep.

At the Los Alamos National Laboratory Plutonium Facility, anion exchange is used for recovering plutonium from nitric acid solutions. Although this approach recovers >99%, the trace amounts of plutonium and other actinides remaining in the effluent require additional processing. We are doing research to develop a secondary unit operation that can directly polish the effluent so that actinide levels are reduced to below the maximum allowed for facility discharge. We selected solvent extraction, the only unit operation that can meet the stringent process requirements imposed; several carbonyl and phosphoryl extractants were evaluated and their performance characterized. We also investigated various engineering approaches for solvent extraction; the most promising was a chelating resin loaded with extractant. Our research now focuses on the synthesis of malonamides, and our goal is to bond these extractants to a resin matrix.

18023 (LA-UR--92-461) **Preliminary assessment of clinoptilolite K/Ar results from Yucca Mountain, Nevada: A potential high-level radioactive waste repository site.** WoldeGabriel, G.; Bish, D.L.; Broxton, D.E.; Chipera, S.J. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920761--1: 7. water-rock interaction conference, Park City, UT (United States), 9-23 Jul 1992). Order Number DE92008473. Source: OSTI; NTIS; INIS; GPO Dep.

At Yucca Mountain, evidence for at least three distinct temporal groups of clinoptilolites can be delineated from the preliminary K/Ar dates (2–3 Ma; 4–5 Ma; 7–11 Ma). The older K/Ar dates that are similar to published illite/smectite ages (9–12 Ma) may be crystallization ages, whereas the younger dates probably represent continued diagenetic reactions of older clinoptilolites with percolating fluids. The K/Ar dates increase with depth, suggesting minimal argon loss in the deeper samples. Internal consistency of the clinoptilolite K/Ar results at different levels within the drill holes suggest that dating of K-rich zeolites may provide useful information for assessing the zeolitization at Yucca Mountain. Variations in the K/Ar dates are probably related to Ar loss during dissolution of older clinoptilolites and to contamination by finely crystalline feldspars.

18024 (NEI-FI--154) **Nuclear Waste Management Programme 1992.** Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Sep 1991 29p. (In Finnish). Order Number DE92628316. Source: OSTI; NTIS (US Sales Only); INIS.

Nuclear Waste Commission of Finnish Power Companies (YJT), founded by nuclear energy producing Imatran Voima Oy (IVO) and Teollisuuden Voima Oy (TVO), coordinates the research work of the companies on nuclear waste management. In YJT's Nuclear Waste Management Programme 1992, an account of the nuclear waste management measures of IVO and TVO is given as required by the Sections 74 and 75 of the Finnish Nuclear Energy Degree. At first, the nuclear waste management situation and the programme of activities are reported. Then the nuclear waste management research programme for the year 1992 and more generally for the years 1993 - 1996 is presented. (author).

18025 (NSS/G--116) **Nirex safety assessment research programme bibliography, 1991.** Cooper, M.J. (AEA Decommissioning and Radwaste, Harwell (United Kingdom)). United Kingdom Nirex Ltd., Harwell (United Kingdom). Sep 1991. 59p. (AEA-D and R--0235.). Order Number DE92628334. Source: OSTI; NTIS (US Sales Only); INIS.

This bibliography lists reports and papers written as part of the Nirex Safety Assessment Research Programme, which is concerned with disposal of low-level and intermediate-level waste (LLW and ILW) and associated radiological assessments. The bibliography has been divided into two sections, a list of Publications in roughly chronological order and an Author Index. The topics involved include near-field and far-field studies. The near-field includes the waste package, filling or sealing materials, and those parts of the host medium whose characteristics have been or could be altered by the repository or its content. The far-field is the rock formation outside the repository, including the surrounding strata, at a distance from the waste disposal site such that, for modelling purposes, the site may be considered as a single entity, and the effects of individual waste packages are indistinguishable in the effects of the whole. The far-field includes also the biosphere, into which radionuclides from the waste could conceivably migrate in the future. (author).

18026 (NSS/R--241) **The application of positron emission tomography to the study of mass transfer in fractured rock.** Gilling, D. (AEA Decommissioning and Radwaste, Harwell (United Kingdom)); Jefferies, N.L.; Fowles, P.; Hawkesworth, M.R.; Parker, D.J. United Kingdom Nirex Ltd., Harwell (United Kingdom). Jun 1991. 13p. Order Number DE92628335. Source: OSTI; NTIS (US Sales Only); INIS.

Water flow in hard rocks takes place dominantly in fractures. In order to predict the transport of dissolved radioelements through a fractured rock it is necessary to determine both the geometry of the fracture network and the hydraulic properties of the individual fractures. This paper describes a technique for studying mass transfer in a single fracture. The technique is positron emission tomography (PET) and it offers the potential for visualising quantitatively the migration of dissolved tracers. Preliminary experiments have been undertaken involving the flow of Na-22 and F-18 labelled solutions through artificial fractures. The results demonstrate that PET is well suited to this application. (author).

18027 (NSS/R--263) **Review of national research programmes on the microbiology of radioactive waste disposal.** Rosevear, A. (AEA Environment and Energy, Harwell (United Kingdom)). United Kingdom Nirex Ltd., Harwell (United Kingdom). Jun 1991. 39p. Order Number DE92628336. Source: OSTI; NTIS (US Sales Only); INIS.

Published results on the microbial effects of relevance to radioactive waste disposal are reviewed. The subjects covered by each of the various national programmes are considered in turn and the important themes that emerge from these are summarised. Finally the relevance of this microbiological research to the Nirex Safety case is discussed in brief. All references to research papers that deal with microbial aspects of radioactive waste disposal are listed and the key publications identified. (author).

18028 (ORNL/ER--23) **Tracer-level radioactive pilot-scale test of in situ vitrification technology for the stabilization of contaminated soil sites at ORNL: Environmental Restoration Program.** Jacobs, G.K.; Spalding, B.P. Oak Ridge National Lab., TN (United States). Nov 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012589. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3806.

This plan summarizes the activities to be performed during FY 1990 and FY 1991 for the tracer-level radioactive pilot-scale in situ vitrification (ISV) test. This test is the second step in evaluating ISV as a remedial action for the pits and trenches at Oak Ridge National Laboratory (ORNL). A previous test used nonradioactive tracers for cesium and strontium. This new test will again use a one-half-scale model of trench 7 and the pilot-scale ISV equipment of Pacific Northwest Laboratory (PNL). A small and precisely known amount of waste from a liquid waste disposal pit will be used for the test. An actually contaminated waste site cannot be used for this test because of the necessity to use an exactly known inventory of radionuclides so that a precise measurement of the volatilization of various constituents to the off-gas can be determined.

18029 (ORNL/ER--25) **Task plan for TARA-II compaction and grouting demonstration: Environmental Restoration Program.** Spalding, B.P. Oak Ridge National Lab., TN (United States). Nov 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012591. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3808.

This task directly supports the corrective measures evaluation for the closure of Solid Waste Storage Area (SWSA) 6 but also supports technology development for the closure of other Oak Ridge National Laboratory (ORNL) SWSAs and waste management units. Previous demonstrations have established the effectiveness of dynamic compaction and in situ grouting in stabilizing burial trenches against subsidence, which would otherwise compromise the support of infiltration barrier structures designed to protect buried waste from leaching. In situ grouting with polyacrylamide has also been demonstrated to improve the hydrologic isolation of buried waste. Both of these stabilization techniques have been demonstrated on burial trenches that are situated well above the water table and, hence, are in a chronic unsaturated moisture regime. Further demonstrations of these shallow-land burial trench stabilization techniques are necessary to establish their effectiveness and safety when applied to burial trenches that are chronically inundated with groundwater.

18030 (PNL–7175) **Interim report cyanide safety studies.** Burger, L.L.; Scheele, R.D. Pacific Northwest Lab., Richland, WA (United States). 30 Sep 1988. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012168. Source: OSTI; NTIS; GPO Dep.

Over the past few years several proposals have been prepared to investigate the potential hazard of ferrocyanide-nitrate reactions that may occur in some Hanford waste tanks. In 1988 Westinghouse Hanford Company (WHC) decided to perform some of the suggested experimental work. Based on the proposal submitted in July, 1988, it was agreed to do a portion of the work during FY 1988. This report summarizes the results of that work, provides a preliminary analysis of the results, and includes recommendations for further study. The work completed consists of a brief literature search, preparation and analysis of several cesium nickel ferrocyanide, $Cs_2NiFe(CN)_6$, oxdiation studies using Differential Scanning Calorimetry (DSC) and Thermogravimetry (TG), and small scale explosion tests.

18031 (PNL–7474) **Three-dimensional modeling of unsaturated flow in the vicinity of proposed exploratory shaft facilities at Yucca Mountain, Nevada.** Rockhold, M.L. (Pacific Northwest Lab., Richland, WA (United States)); Sagar, B.; Connelly, M.P. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012319. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the results of a study to investigate the influence of proposed exploratory shafts on the moisture distribution within unsaturated, fractured rock at Yucca Mountain, Nevada. The long-term effects of exploratory shafts at Yucca Mountain are important in the estimation of potential waste migration and fate, while short-term effects may be important in the planning and interpretation of tests performed at the site. The PORFLO-3 computer code was used for simulation of moisture flow through the geologic units adjacent to the ESF. Rather than represent fractures as discrete elements, an equivalent continuum was stipulated, in which the fractured units were assigned equivalent or composite hydrologic properties. Explicit treatment of fractures is not feasible because of the extremely large number of fractures contained in the site-scale problem and the difficulties in characterizing and modeling the fracture geometries.

18032 (PNL–7488-Ver.1.0) **Solid waste projection model: Database version 1.0 technical reference manual.** Carr, F.; Bowman, A. Pacific Northwest Lab., Richland, WA (United States). Nov 1990. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE91005213. Source: OSTI; NTIS; GPO Dep.

The Solid Waste Projection Model (SWPM) system is an analytical tool developed by Pacific Northwest Laboratory (PNL) for Westinghouse Hanford Company (WHC). The SWPM system provides a modeling and analysis environment that supports decisions in the process of evaluating various solid waste management alternatives. This document, one of a series describing the SWPM system, contains detailed information regarding the software and data structures utilized in developing the SWPM Version 1.0 Database. This document is intended for use by experienced database specialists and supports database maintenance, utility development, and database enhancement. Those interested in using the SWPM database should refer to the SWPM Database User's Guide. 14 figs., 6 tabs.

18033 (PNL–8028) **Research, development, demonstration, testing, and evaluation characterization technology project: FY90 year-end report on subsurface detection methods.** Sandness, G.A.; Stewart, T.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011510. Source: OSTI; NTIS; GPO Dep.

Most of the site cleanup projects to be conducted at US Department of Energy (DOE) facilities will include subsurface investigations using geophysical sensors. When performed at an early state of a site characterization effort, they will help define site boundaries and waste distributions, provide guidance for the optimization of subsurface sampling plans, reduce the cost of site exploration tasks, and enhance the safety of personnel involved in sampling and excavation activities. In FY 89, researchers of Pacific Northwest Laboratory constructed a digital data acquisition system (DAS) to be used in geophysical surveys of hazardous waste burial sites. The DAS is essentially a specialized microcomputer that has been ruggedized to permit operation on a moving off-road vehicle. It was designed primarily to record and display ground-penetrating radar (GPR) data, but it is capable of simultaneously or separately recording data produced by other types of geophysical sensors. Our work in FY 90 focused primarily on improving certain hardware components of the DAS and on writing the software needed to process and display the recorded data on a personal computer (PC)-based data processing system. A secondary aspect of our work during the past year was constructed and testing a breadboard version of a time-domain metal detector. Metal detectors are commonly used in site characterization surveys to detect and map metallic wastes such as 55-gal drums, storage tanks, pipes, and cables. However, currently available instruments tend to be unstable, difficult to use, and generally unsuitable for quantitative site characterization measurements.

18034 (PNL–8029) **Evaluation of potential releases from single-shell tanks.** Ramsdell, J.V. Jr. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011508. Source: OSTI; NTIS; GPO Dep.

Potential toxic chemical concentrations in the air near vents of single-shell tanks have been evaluated using three scenarios. The first scenario duplicates the conditions existing the morning of January 28, 1992, when several workers reported exposure to toxic or irritating gases near the BX and BY tank farms in the 200-East Area at Hanford. The results of this scenario indicate that it is unlikely that a tank in either tank farm could have been the source of the gases associated with the incident. In the other two scenarios, maximum potential concentrations under worst-cast and bounding conditions were examined. The results of theses scenario show that air concentrations of all toxic gases reported to be in the tanks fall below their time-weighted average, threshold limiting values within 5 m of tank vents under worst-case conditions involving a restricted air flow to the tanks. When unrestricted air flow to the tanks and worst-case conditions are assumed, the maximum gas concentrations fall below time-weighted average, threshold limiting values within 15 m of vents.

18035 (PNL-SA–19941) **Testing and COBRA-SFS analysis of the VSC-17 ventilated concrete, spent fuel storage cask.** McKinnon, M.A. (Pacific Northwest Lab., Richland, WA (United States)); Dodge, R.E.; Schmitt, R.C. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–91: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012326. Source: OSTI; NTIS; INIS; GPO Dep.

A performance test of a Pacific Sierra Nuclear VSC-17 ventilated concrete storage cask loaded with 17 canisters of consolidated PWR spent fuel generating approximately 15 kW was conducted. The performance test included measuring the cask surface, concrete, air channel surface, and fuel temperatures, as well as cask surface gamma and neutron dose rates. Testing was performed using vacuum, nitrogen, and helium backfill environments. Pretest predictions of cask thermal performance were made using the COBRA-SFS computer code. Analysis results were within 15°C of measured peak fuel temperature. Peak fuel temperature for normal operation was 321°C. In general, the surface dose rates were less than 30 mrem/h on the side of the cask and 40 mrem/h on the top of the cask.

18036 (PNL-SA–19967) **International status of dry storage of spent fuels.** Schneider, K.J.; Mitchell, S.J.; Johnson, A.B. Jr. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–80: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012343. Source: OSTI; NTIS; INIS; GPO Dep.

Spent fuel from the world's nuclear power reactors, or the high-level radioactive wastes from reprocessing of the spent fuels, are planned to be disposed of in national deep geological repositories in the respective countries of origin. The plans for most countries with nuclear power call for spent fuel or high-level waste disposal to start between 2010 and about 2050. Although storage in water pools is the primary method for management of spent nuclear fuels for the first few years after discharge from the reactor, dry storage has been implemented in several countries and is being considered in others. Dry storage is generally planned for an interim period (from 10 to as long as 100 years) until the spent fuel is disposed of or until a final decision is made on reprocessing. Dry storage is also being used to supplement wet storage capacity at some nuclear power stations. This paper summarizes the worldwide status of dry spent fuel storage and information on the expected long-term integrity of the dry-stored spent fuel based on experience, particularly for Zircaloy-clad fuels. The paper also addresses briefly the dry storage of solidified high-level radioactive wastes. This paper is based on work carried out for the US Department of Energy (DOE) by the Pacific Northwest Laboratory.

18037 (PNL-SA–20057) **Locations, volumes, and characteristics of DOE's mixed low-level wastes.** Ross, W.A. (Pacific Northwest Lab., Richland, WA (United States)); Elmore, M.R.; Warner, C.L.; Wachter, L.J.; Carlson, W.L.; Devries, R.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307–69: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011282. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed Waste Treatment Project (MWTP) has collected and analyzed mixed low-level waste data to assist in developing treatment capability for the US Department of Energy's (DOE) wastes. Initial data on the characteristics of mixed waste was obtained from the Waste Management Information System (WMIS) data base, and has been updated based on visits to DOE sites where most of the wastes are generated and stored. The streams of interest have a current inventory of about 70,000 m^3 and a generation rate of about 7,700 m^3/yr. The twelve sites with the most significant processing needs are Fernald, Hanford, K-25 (Oak Ridge), Idaho National Engineering Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory (ORNL), Paducah Gaseous Diffusion Plant, Portsmouth Gaseous Diffusion Plant, Rocky Flats Plant, Savannah River Site (SRS), and Y-12 (Oak Ridge). These twelve sites account for about 98% of the mixed waste volumes. The wastes have been assigned to specific waste characterization categories. The largest category in current interim storage is inorganic solids, with sludges, filter cakes, and residues the largest specific subcategory. Aqueous liquids are the largest currently generated stream. The other large categories are solid organics, metals wastes, and heterogeneous wastes. Organic liquids, which have been a major focus, are the smallest of the categories.

18038 (PNL-SA–20212) **The Hybrid Treatment Process for treatment of mixed radioactive and hazardous wastes.** Ross, W.A.; Kindle, C.H. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920448–1: 94. annual meeting and exposition of the American Ceramic Society, Minneapolis, MN (United States), 12-16 Apr 1992). Order Number DE92012342. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a new process for treating mixed hazardous and radioactive waste, commonly called mixed waste. The process is called the Hybrid Treatment Process (HTP), so named because it is built on the 20 years of experience with vitrification of wastes in melters, and the 12 years of experience with treatment of wastes by the in situ vitrification (ISV) process.

18039 (PNL-SA–20258) **Computer modeling of forced mixing in waste storage tanks.** Eyler, L.L.; Michener, T.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–76: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012346. Source: OSTI; NTIS; INIS; GPO Dep.

Numerical simulation results of fluid dynamic and physical processes in radioactive waste storage tanks are presented. Investigations include simulation of jet mixing pump induced flows intended to mix and maintain particulate material uniformly distributed throughout the liquid volume. Physical effects of solids are included in the code. These are particle size through a settling velocity and mixture properties through density and viscosity. Calculations have been accomplished for a centrally located, rotationally-oscillating, horizontally-directed jet mixing pump for two cases. One case is with low jet velocity and high settling velocity. It results in nonuniform distribution. The other case is with high jet velocity and low settling velocity. It results in uniform conditions. Results are being used to aid in experiment design and to understand mixing in the waste tanks. These results are to be used in conjunction with scaled experiments to define limits of pump operation to maintain uniformity of the mixture in the storage tanks during waste retrieval operations.

18040 (PNL-SA–20353) **Physical mechanisms contributing to the episodic gas release from Hanford tank 241-SY-101.** Allemann, R.T. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–75: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012345. Source: OSTI; NTIS; INIS; GPO Dep.

Volume growth of contents in a waste storage tank at Hanford is accompanied by episodic releases of gas and a rise in the level of tank contents. A theory is presented to describe how the gas is retained in the waste and how it is released. The theory postulates that somewhat cohesive gobs of sludge rise from the lower regions of the tank and buoyancy overcomes the cohesive strength of the slurry; this quantitatively explains several of the measured phenomena and qualitatively explains other observations.

18041 (PNL-SA–20361) **Human factors programs for high-level radioactive waste handling systems.** Pond, D.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–90: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012328. Source: OSTI; NTIS; INIS; GPO Dep.

Human Factors is the discipline concerned with the acquisition of knowledge about human capabilities and limitations, and the application of such knowledge to the design of systems. This paper discusses the range of human factors issues relevant to high-level radioactive waste (HLRW) management systems and, based on examples from other organizations, presents mechanisms through which to assure application of such expertise in the safe, efficient, and effective management and disposal of high-level waste. Additionally, specific attention is directed toward consideration of who might be classified as a human factors specialist, why human factors expertise is critical to the success of the HLRW management system, and determining when human factors specialists should become involved in the design and development process.

18042 (PNL-SA-20362) **First-order model for durability of Hanford waste glasses as a function of composition.** Hrma, P.; Piepel, G.F.; Schweiger, M.J.; Smith, D.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–79: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012563. Source: OSTI; NTIS; INIS; GPO Dep.

Two standard chemical durability tests, the static leach test MCC-1 and product consistency test PCT, were conducted on simulated borosilicate glasses that encompass the expected range of compositions to be produced in the Hanford Waste Vitrification Plant (HWVP). A first-order empirical model was fitted to the data from each test method. The results indicate that glass durability is increased by addition of Al_2O_3, moderately increased by addition of ZrO_2 and SiO_2, and decreased by addition of Li_2O, Na_2O, B_2O_3, and MgO. Addition of Fe_2O_3 and CaO produce an indifferent or reducing effect on durability according to the test method. This behavior and a statistically significant lack of fit are attributed to the effects of multiple chemical reactions occurring during glass-water interaction. Liquid-liquid immiscibility is suspected to be responsible for extremely low durability of some glasses.

18043 (PNL-SA-20371) **Dissolution rates of as-received and partially oxidized spent fuel.** Gray, W.J.; Thomas, L.E.; Einziger, R.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–77: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012348. Source: OSTI; NTIS; INIS; GPO Dep.

Dissolution rates have been measured for spent fuel in both unoxidized and partially air-oxidized conditions (oxygen-to-metal ratio of 2.4 with U_4O_9 crystallographic structure), as well as for unirradiated UO_2 and UO_2 that was partially oxidized to U_3O_7. All measurements were taken in flow-through tests where uranium concentrations were maintained well below solubility limits to avoid suppression of the measured dissolution rates by solubility constraints. No significant differences in dissolution behavior were found between the oxidized and unoxidized spent fuel or between unirradiated UO_2 and U_3O_7.

18044 (PNL-SA-20380) **Oxidation of spent fuel in air at 175° to 195°C.** Einziger, R.E. (Pacific Northwest Lab., Richland, WA (United States)); Buchanan, H.C.; Thomas, L.E.; Stout, R.B. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–78: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012349. Source: OSTI; NTIS; INIS; GPO Dep.

Oxidation tests in dry air were conducted on four LWR spent fuels at 175° and 195°C to determine the effect of the fuel characteristics on the oxidation state likely to exist at the time leaching occurs in a potential repository. Weight changes were measured and samples were examined by XRD, ceramography, TEM, and TGA. Despite local variations in the grain boundary susceptibility to oxidation, all four fuels progressed toward an apparent endpoint at an oxygen-to-metal (O/M) ratio of 2.4. The sole oxidation product was U_4O_{9+x}, a cubic phase structurally related to UO_2 but with a slightly smaller lattice constant. The growth of the U_4O_{9+x} from the grain boundaries into the UO_2 grains followed parabolic kinetics and had an activation energy of 26.6 kcal/mol. Based on the kinetics, the time required at 95°C to completely oxidize LWR spent fuel to U_4O_{9+x} would be at least 2000 yr. The next oxidation product to form after the U_4O_{9+x} phase may be U_3O_8, but no U_3O_8 or other dilatational oxidation product has been detected in these accelerated tests conducted up to 25,000 h.

18045 (PNL-SA-20510) **Office of Technology Development's integrated program for development of in situ remediation technologies.** Peterson, M.E. (Pacific Northwest Lab., Richland, WA (United States)); Shupe, M.; Walker, J.; Ellis, B. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307–52: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010495. Source: OSTI; NTIS; INIS; GPO Dep.

The In-Situ Remediation Integrated Program (ISR IP) was initiated in FY 1991 and is progressing through the planning stages. The ISR IP currently plans to invest in the development of in situ bioremediation for the cleanup of volatile organics in the vadose zone and in groundwater, and in R&D activities to support the development of electrokinetics. Additional investment decisions will be made as a result of convening technical support groups to evaluate and recommend R&D activities for other in situ remediation technologies. The major activities for this fiscal year include the overall planning for the ISR IP. A five-year program plan to be prepared later this year will establish the long-term goals for the program. To support the preparation of this plan, interfaces with the integrated demonstrations, environmental restoration and waste operations have been formed to assure that the R&D activities are focused on the priority problem descriptions and technology needs.

18046 (POEF–2094) **Waste management strategic plan.** Portsmouth Gaseous Diffusion Plant, OH (United States). Mar 1992. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE92011647. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the Portsmouth Gaseous Diffusion Plant (PORTS) Waste Management Program is to manage wastes in a manner which is protective of human health and the environment; meets all regulatory requirements and Department of Energy (DOE) Orders; allows production and production support activities to operate without significant impact; minimizes waste generation and disposal to the greatest extent practicable; is cost efficient, and exceeds expectations of DOE and Martin Marietta Energy Systems, Inc. (MMES) management. Consistent with this goal by the year 2002 PORTS will have fully implemented an integrated waste management strategy in which there is not waste in long-term storage.

18047 (SAND–88-0585) **G-Tunnel pressurized slot-testing preparations: Yucca Mountain Site Characterization Project.** Zimmerman, R.M. (Sandia National Labs., Albuquerque, NM (United States)); Sifre-Soto, C.; Mann, K.L.; Bellman, R.A. Jr.; Luker, S.; Dodds, D.J. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92014170. Source: OSTI; NTIS; INIS; GPO Dep.

Designers and analysts of radioactive waste repositories must be able to predict the mechanical behavior of the host rock. Sandia National laboratories elected to conduct a development program on pressurized slot testing and featured (1) development of an improved method to cut slots using a chain saw with diamond-tipped cutters, (2) measurements useful for determining in situ stresses normal to slots, (3) measurements applicable for determining the in situ modulus of deformation parallel to a drift surface, and (4) evaluations of the potentials of pressurized slot strength testing. This report describes the preparations leading to the measurements and evaluations.

18048 (SAND–88-1331) **G-Tunnel Welded Tuff Mining Experiment instrumentation evaluations: Yucca Mountain Site Characterization Project.** Zimmerman, R.M. (Sandia National Labs., Albuquerque, NM (United States)); Bellman, R.A. Jr.; Mann, K.L.; Thompson, T.W. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013768. Source: OSTI; NTIS; INIS; GPO Dep.

Designers and analysts of radioactive waste repositories must be able to predict the mechanical behavior of the host rock. Sandia National Laboratory has conducted a mine-by experiment in welded tuff so that information could be obtained regarding the response of the rock to a drill and blast excavation process, where smooth-blasting techniques were used. This report describes the results of the evaluations of nine different instrument or measurement systems used in conjunction with these mining activities.

18049 (SAND–88-7124) **Waste package emplacement borehole option study: Yucca Mountain Site Characterization Project.** Streeter, W.S. (Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (United States)). Sandia National Labs., Albuquerque, NM (United States); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (United States). Mar 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013459. Source: OSTI; NTIS; INIS; GPO Dep.

This study evaluates the cost and thermal effects of various waste package emplacement configurations that differ in emplacement orientation, number of containers per borehole, and standoff distance at the potential Yucca Mountain nuclear waste repository. In this study, eight additional alternatives to the vertical and horizontal orientation options presented in the Site Characterization Plan Conceptual Design Report are considered. Typical panel layout configurations based on thermal analysis of the waste and cost estimates for design and construction, operations, and closure and decommissioning were made for each emplacement option. For the thermal analysis average waste 10 years out of reactor and the SIM code were used to determine whether the various configurations temperatures would exceed the design criteria for temperature. This study does not make a recommendation for emplacement configuration, but does provide information for comparison of alternatives.

18050 (SAND–89-0972/2) **MISTY ECHO tunnel dynamics experiment data report: Volume 2, Appendices: Yucca Mountain Site Characterization Project.** Phillips, J.S.; Luke, B.A.; Long, J.W.; Lee, J.G. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012615. Source: OSTI; NTIS; INIS; GPO Dep.

Tunnel damage resulting from seismic loading is an important issue for the Yucca Mountain nuclear waste repository. The tunnel dynamics experiment was designed to obtain and document ground motions, permanent displacements, observable changes in fracture patterns, and visible damage at ground motion levels of interest to the Yucca Mountain Project. Even though the maximum free-field loading on this tunnel was 28 g, the damage observed was minor. Fielding details, data obtained, and supporting documentation are reported.

18051 (SAND–89-7007) **Transportation cask decontamination and maintenance at the potential Yucca Mountain repository: Yucca Mountain Site characterization project.** Hartman, D.J. (Bechtel National, Inc., San Francisco, CA (United States)); Miller, D.D.; Hill, R.R. Sandia National Labs., Albuquerque, NM (United States); Bechtel National, Inc., San Francisco, CA (United States). Apr 1992. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013055. Source: OSTI; NTIS; INIS; GPO Dep.

This study investigates spent fuel cask handling experience at existing nuclear facilities to determine appropriate cask decontamination and maintenance operations at the potential Yucca Mountain repository. These operations are categorized as either routine or nonroutine. Routine cask decontamination and maintenance tasks are performed in the cask preparation area at the repository. Casks are taken offline to a separate cask maintenance area for major nonroutine tasks. The study develops conceptual designs of the cask preparation area and cask maintenance area. The functions, layouts, and major features of these areas are also described.

18052 (SAND–90-2882) **An investigation of the impact of conceptual model uncertainty on the estimated performance of a hypothetical high-level nuclear waste repository site in unsaturated, fractured tuff: Yucca Mountain Site Characterization Project.** Gallegos, D.P. (Sandia National Labs., Albuquerque, NM (United States)); Phol, P.I.; Updegraff, C.D. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012685. Source: OSTI; NTIS; INIS; GPO Dep.

Performance assessment modeling for High Level Waste (HLW) disposal incorporates three different types of uncertainty. These include data and parameter uncertainty, modeling uncertainty (which includes conceptual, mathematical, and numerical), and uncertainty associated with predicting the future state of the system. In this study, the potential impact of conceptual model uncertainty on the estimated performance of a hypothetical high-level radioactive waste disposal site in unsaturated, fractured tuff has been assessed for a given group of conceptual models. This was accomplished by taking a series of six, one-dimensional conceptual models, which differed only by the fundamental assumptions used to develop them, and conducting ground-water flow and radionuclide transport simulations. Complementary cumulative distribution functions (CCDFs) representing integrated radionuclide release to the water table indicate that differences in the basic assumptions used to develop conceptual models can have a significant impact on the estimated performance of the site. Because each of the conceptual models employed the same mathematical and numerical models, contained the same data and parameter values and ranges, and did not consider the possible future states of the system, changes in the CCDF could be attributed primarily to differences in conceptual modeling assumptions. Studies such as this one could help prioritize site characterization activities by identifying critical and uncertain assumptions used in model development, thereby providing guidance as to where reduction of uncertainty is most important.

18053 (SAND–91-1299) **An evaluation of radionuclide batch sorption data on Culebra dolomite for aqueous compositions relevant to the human intrusion scenario for the Waste Isolation Pilot Plant.** Novak, C.F. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011517. Source: OSTI; NTIS; INIS; GPO Dep.

Transport models used for performance assessment of the Waste Isolation Pilot Plant (WIPP) in the event of human intrusion into the repository currently rely on the K_d linear sorption isotherm model to predict rates of radionuclide migration. The vast majority of K_d data was measured in static (batch) experiment on powdered substrate; most data specific to the Culebra dolomite were gathered in this way for five radioelements of concern using up to four different water compositions. This report summarizes the available data, examines inconsistencies between these data and the assumptions of the K_d model, and discusses potential difficulties in using existing sorption data for predictive modeling of radionuclide retardation through adsorption modeling are presented as an alternative to the K_d model.

18054 (SAND–91-1730C) **A study of discrete and continuum joint modeling techniques.** Jung, J.; Brown, S.R. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920633–1: Fractured and jointed rock masses conference, Lake Tahoe, CA (United States), 3-5 Jun 1992). Order Number DE92012631. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of a numerical and experimental study in which finite element and discrete element techniques were used to analyze a layered polycarbonate plate model subjected to uniaxial compression. Also, the two analysis techniques were used to compute the response of an eight meter diameter drift in jointed-rock. The drift was subjected to in-situ and far-field induced thermal stresses. The finite element analyses used a continuum rock model to represent the jointed-rock. A comparison of the analyses showed that the finite element continuum joint model consistently predicted less joint slippage than did the discrete element analyses, although far-field displacements compared well.

18055 (SAND–92-0091C) **Recent characterization activities of Midway Valley as a potential repository surface facility site.** Gibson, J.D. (Sandia National Labs., Albuquerque, NM (United States)); Wesling, J.R.; Swan, F.H.; Bullard, T.F. Sandia National Labs., Albuquerque, NM (United States). 31 Jan 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920307–67: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011382. Source: OSTI; NTIS; INIS; GPO Dep.

Midway Valley, located at the eastern base of Yucca Mountain, Nye County, Nevada, has been identified as a possible location for the surface facilities of a potential high-level nuclear-waste repository. This structural and topographic valley is bounded by two north- trending, down-to-the-west normal faults: the Paintbrush Canyon fault on the east and the Bow Ridge fault on the west. Surface and near-surface geological data have been acquired from Midway Valley during the past three years with particular emphasis on evaluating the existence of Quaternary faults. A detailed (1:6000) surficial geological map has been prepared based on interpretation of new and existing aerial photographs, field mapping, soil pits, and trenches. No evidence was found that would indicate displacement of these surficial deposits along previously unrecognized faults. However, given the low rates of Quaternary faulting and the extensive areas that are covered by late Pleistocene to Holocene deposits south of Sever Wash, Quaternary faulting between known faults cannot be precluded based on surface evidence alone. Middle to late Pleistocene alluvial fan deposits (Unit Q3) exist at or near the surface throughout Midway Valley. Confidence is increased that the potential for surface fault rupture in Midway Valley can be assessed by excavations that expose the deposits and soils associated with Unit Q3 or older units (middle Pleistocene or earlier).

18056 (SAND–92-0302) **Sandia National Laboratories process development report: Weapon Hazardous Material Identification.** Dhooge, N.J. (ed.); Ulrich, W.D.; Adkins, W.N.; Anderson, F.H.; Baldwin, A.R.; Chambers, W.B.; Chavez, S.L.; Clabaugh, J.S. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012614. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Hazardous Material Identification Report is the documentation of the Weapon Hazardous Material Identification Process Development Team's effort to develop a process for the identification of environmentally hazardous materials used in weapons and weapon components. The report includes a guide to the precharacterization of excess weapon hardware for environmental and safety hazards prior to delivering that hardware to the waste management agency or organization. It also includes a procedure for planning a pre-disposal process for the hardware with regard to declassification, demilitarization, and separation/expenditure of certain discrete hazards. Final characterization of the resultant waste streams is left to the cognizant waste management agency or organization.

18057 (SKB-TR–91-43) **SKB - PNC. Development of tunnel radar antennas.** Falk, L. (ABEM, Uppsala (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jul 1991. 95p. Order Number DE92628337. Source: OSTI; NTIS (US Sales Only); INIS.

Tunnel antennas for the RAMAC borehole radar system have been developed and tested in the field. The antennas are of the loaded dipole type and the receiver and transmitter electronics have been rebuilt to screen them from the antennas. A series of measurements has demonstrated that the radar pulse is short and well shaped and relatively free from ringing, even compared with the existing borehole antennas. Two antenna sets were tested: one centered at 60 MHz and another above 100 MHz. Both produced excellent radar pictures when tested in tunnels in Stripa mine. The antennas have been designed to be easy to carry, since the signal quality often depends on the way the antenna is held relative to electric conductors in the tunnels. (au) (46 figs., 57 refs.).

18058 (SR/CNEAF–92-01) **Spent nuclear fuel discharges from US reactors 1990.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 13 Mar 1992. 207p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011250. Source: OSTI; NTIS; INIS; GPO Dep.

The Energy Information Administration (EIA) of the US Department of Energy (DOE) administers the Nuclear Fuel Data survey, Form RW-859, which is used to collect data on every fuel assembly irradiated in commercial nuclear reactors operating in the United States, and on the current inventories and storage capacities of those reactors. These data are important to the design and operation of the equipment and facilities that will be used by the DOE for the future acceptance, transport, and disposal of all spent fuel. The information presented in this report summarizes the detailed data collected on the Nuclear Fuel Data Form RW-859, and identifies trends in burnup and enrichment that are evident in these data. This report focuses on commercial light-water reactor (LWR) spent nuclear fuel reported as discharged as of December 31, 1990.

18059 (UCRL–21215-91-Add.A) **Cost-benefit analysis for waste compaction alternatives at Lawrence Livermore National Laboratory: Addendum A to the Waste Minimization and Pollution Prevention Awareness Plan of May 31, 1991.** Lawrence Livermore National Lab., CA (United States); Science Applications International Corp., Pleasanton, CA (United States). Jan 1992. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013512. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a cost-benefit analysis of the potential procurement and operation of various solid waste compactors or of the use of commercial compaction services, for compaction of solid transuranic (TRU), low-level radioactive, hazardous, and mixed wastes at Lawrence Livermore National Laboratory (LLNL) Hazardous Waste Management (HWM) facilities. The cost-benefit analysis was conducted to determine if increased compaction capacity at HWM might afford the potential for significant waste volume reduction and annual savings in material, shipping, labor, and disposal costs.

18060 (UCRL–21215-91-Add.B) **Cost-benefit analysis for waste segregation at Lawrence Livermore National Laboratory: Addendum B to the waste minimization and pollution prevention awareness plan of May 31, 1991.** Lawrence Livermore National Lab., CA (United States); Science Applications International Corp., Pleasanton, CA (United States). Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012679. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a cost-benefit analysis for the segregation of mixed, hazardous, and nonhazardous wastes at Lawrence Livermore National Laboratory (LLNL). The cost-benefit analysis was conducted to determine if current waste segregation practices and additional candidates for waste segregation at LLNL might have the potential for significant waste source reduction and annual savings in treatment and disposal costs. In the following cost-benefit analysis, capital costs and recurring costs of waste segregation practices are compared to the economic benefits of savings in treatment and disposal costs. Indirect or overhead costs associated with these wastes are not available and have not been included. Not considered are additional benefits of waste segregation such as decreased potential for liability to LLNL for adverse environmental effects, improved worker safety, and enhanced LLNL image within the community because of environmental improvement. The economic evaluations in this report are presented on a Lab-wide basis. All hazardous wastes generated by a program are turned over to the Hazardous Waste Management (HWM) group, which is responsible for the storage, treatment, or disposal of these wastes and funded funded directly for this work.

18061 (UCRL-CR–109641) **Dynamic fracture from a cavity in soft tuff between two hard layers.** Rimer, N. (S-Cubed, La Jolla, CA (United States)); Halda, E. Lawrence Livermore National Lab., CA (United States); S-Cubed, La Jolla, CA (United States). 5 Jan 1987. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (SSS-R–87-8437). Order Number DE92010443. Source: OSTI; NTIS; GPO Dep.

This report describes a calculational investigation of the containment implications associated with a working point in a unique geologic setting, a soft working point tuff layer sandwiched between two much harder rock layers, a saturated RHYOLITE below, and a thick layer of strong welded RAINIER MESA TUFF (TMR) above. Since the TMR layer has been found to contain open vertical cooling cracks (of unknown extents), any gas-filled hydrofractures from the cavity which penetrate to this layer could potentially link up with these cooling cracks to provide a seep path toward the surface. Here we described the results of two axisymmetric calculations for this geologic structure using the Lagrangian CRAM code with the new dynamic fracture model developed at S-CUBED and presented at the 159th CEP meeting. September 17,

1986. This new model calculates the opening, propagation and closing of cavity gas-filled hydrofractures during the dynamic ground motions. Coupled interactions at every computational cycle of the calculations between the pressurized fractures and the nonlinear ground motions allow the expanding fractures to alter ground motions and these motions to influence the crack porosities and opening displacements of the fracture. In these calculations we make the conservative assumption that the fluid pressures in the entire crack network are identical to cavity pressure.

18062 (UCRL-JC–107901) **The structure of alteration layers on cast glass surfaces.** Oversby, V.M.; Phinney, D.L. Lawrence Livermore National Lab., CA (United States). Nov 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911123–4: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE92011535. Source: OSTI; NTIS; INIS; GPO Dep.

Alteration layers developed on SRL-165 simulated waste glasses in dilute sodium silicate/bicarbonate leaching solutions have been examined by Secondary Ionization Mass Spectroscopy (SIMS) using fine-scale, multiple-element depth profiling. Selected samples were examined with an imaging detector system, which demonstrated the horizontal homogeneity of the layer development at all depths within the layer. After 1 day of reaction at 90°C the reaction layer shows depletion of glass elements to a depth of 0.2 μm. The surface of the layer in contact with the solution shows enrichment of Si, Al, and alkali elements even at this short reaction time, suggesting the early stages of development of secondary aluminosilicate phases. With increased reaction time, the layer thickens to about 1.3 μm at 91 days, while the evidence for aluminosilicate development at the surface of the layer becomes more prominent. Penetration of hydrogen into the "unreacted" glass proceeds to a depth of about 0.5 μm deeper than the alkali depletion zone. This suggests the mechanism of initial reaction of the glass is by attack of the silicate structure by molecular water or hydroxide ion rather than by alkali-hydrogen ion exchange. The simple structure of the layers developed in the silicate solution is in contrast to the complexity of layer structure found when glasses are reacted in deionized water. Since the conditions for geologic disposal will be closer to those used in the silicate leaching experiments, these results hold promise for the ability to model the system to predict long-term performance after disposal in a repository.

18063 (USGS/OFR–90-355) **Chemical analyses of water from selected wells and springs in the Yucca Mountain Area, Nevada and Southeastern California.** McKinley, P.W.; Long, M.P.; Benson, L.V. Geological Survey, Denver, CO (United States). 1991. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-78ET44802. Order Number DE91015225. Source: OSTI; INIS; NTIS; US Geological Survey, Books and Open-File Reports Section, Federal Center Box 25425, Denver, CO 80225-0425; GPO Dep.

Chemical analysis of water samples from 279 wells and springs in the Yucca Mountain area are presented. Where data are available, this report includes: site location expressed as Nevada Central Coordinates and latitude and longitude; source of data; name of analyzing laboratory; geologic unit from which water was obtained; lithology; water use; elevation of well or spring; well depth; depth to water; time pumped before taking the sample; yield; type of filtration; sampling method; data the sample was collected; and anion- cation balance. 15 refs., 6 figs., 10 tabs.

18064 (USGS-OFR–91-367) **Seismicity and focal mechanisms for the Southern Great Basin of Nevada and California in 1990.** Harmsen, S.C. Geological Survey, Denver, CO (United States). 1991. 103p. Sponsored by Department of the Interior, Washington, DC (United States). DOE Contract AI08-78ET44802. Order Number DE92011869. Source: OSTI; NTIS; GPO Dep.

For the calendar year 1990, the Southern Great Basin seismic network (SGBSN) recorded about 1050 earthquakes in the SGB, as compared to 1190 in 1989. Local magnitudes, M_L, ranged from 0.0 for various earthquakes to 3.2 for an earthquake on April 3, 1990 5:47:58 UTC, 37.368° North, 117.358° West, Mud Lake, Nevada quadrangle. 95% of those earthquakes have the property, $M_L \leq 2.4$. Within a 10 km radius of the center of Yucca Mountain, the site of a potential national, high-level nuclear waste repository, one earthquake with $M_L = 0.6$ was recorded at 40-Mile Wash. The estimated depth of focus of this earthquake is 3.8 km below sea level. Other, smaller events may have also occurred in the immediate vicinity of Yucca Mountain, but would have been below the detection threshold ($M_L \approx 0.0$ at Yucca Mountain). Focal mechanisms are computed for seventeen earthquakes in the Nevada Test Site (NTS) and in the SGB west of the NTS for the year 1990. Solutions are mostly strike-slip, although normal slip is observed for a hypocenter at Stonewall Flat, Nevada, and reverse slip is observed for a hypocenter at Tucki Mountain, California. The average direction of the focal mechanism P-axes is North 47° East, with nearly horizontal inclination, and the average direction of the T-axes is North 42° West, with nearly horizontal inclination, consistent with a regional tectonic model of active northwest extension during the Holocene epoch.

18065 (WHC-EP–0422-Rev.1) **A plan to implement remediation of waste tank safety issues at the Hanford Site: Revision 1.** Wilson, G.R.; Reep, I.E. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012256. Source: OSTI; NTIS; INIS; GPO Dep.

Public Law 101-510 requires that the Secretary of Energy report to the US Congress on Hanford Site high-level nuclear waste tank safety issues. This report was prepared to provide the Secretary with the information needed to respond to Congress. It addresses the actions being taken to promote tank safety and the timetable for resolving the safety issues on how to handle the waste in such tanks. This report documents the status of the program, the safety issues that have been identified, and the technical basis for each. Also, this report provides action plans to remediate the issues so that the waste can be safely retained in the waste tanks until removed for final disposal. Integrated planning schedules to close out all safety issues are also provided.

18066 (WHC-EP–0474-3) **Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending December 31, 1991.** Cash, R.J.; Dukelow, G.T.; Atwood, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012197. Source: OSTI; NTIS; INIS; GPO Dep.

This quarterly report provides a status of the activities underway at the Hanford Site on the ferrocyanide safety issues as requested by the Defense Nuclear Facilities Safety Board (DNFSB) in their Recommendation 90-7 (FR 1990). In March 1991, an DNFSB Implementation Plan (Cash 1991a) was prepared and sent to the DNFSB responding to the six parts of Recommendation 90-7. All of the activities in the DNFSB Implementation Plan are underway and the status of each is described.

18067 (WHC-EP–0505) **Inservice inspection of double-shell storage tanks at the Hanford Site.** Blackburn, L.D.; Benny, H.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012205. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a technical rationale for developing requirements for future inservice inspection of Hanford Site double-shell tanks containing radioactive waste. The focus is on identification of examinations and tests needed to confirm structural integrity of the tank for continued operations. A review of codes and standards for other areas, such as nuclear power plant components, boilers and pressure vessels, and concrete structures, led to the conclusion that such documents are not directly applicable to double-shell tanks. A comparison of potential modes of degradation of tank materials and information from laboratory or field simulation tests used for design and construction revealed no significant weaknesses in the intended protection against deterioration that might challenge structural integrity. Consideration of potential degradation modes and structural loadings on the tanks led to the identification of locations to be examined and examination or test methods to be employed. The establishment of an inspection frequency and of evaluation standards for examinations or tests are also discussed.

18068 (WHC-EP-0533) **Integrated sampling and analysis plan for samples measuring >10 mrem/hour.** Haller, C.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92011288. Source: OSTI; NTIS; INIS; GPO Dep.

This integrated sampling and analysis plan was prepared to assist in planning and scheduling of Hanford Site sampling and analytical activities for all waste characterization samples that measure greater than 10 mrem/hour. This report also satisfies the requirements of the renegotiated Interim Milestone M-10-05 of the Hanford Federal Facility Agreement and Consent Order (the Tri-Party Agreement). For purposes of comparing the various analytical needs with the Hanford Site laboratory capabilities, the analytical requirements of the various programs were normalized by converting required laboratory effort for each type of sample to a common unit of work, the standard analytical equivalency unit (AEU). The AEU approximates the amount of laboratory resources required to perform an extensive suite of analyses on five core segments individually plus one additional suite of analyses on a composite sample derived from a mixture of the five core segments and prepare a validated RCRA-type data package.

18069 (WHC-EP-0533-Draft) **Integrated sampling and analysis plan for samples measuring >10 mrem/hour.** Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92011456. Source: OSTI; NTIS; GPO Dep.

This integrated sampling and analysis plan was prepared to assist in planning and scheduling of Hanford Site sampling and analytical activities for all waste characterization samples that measure greater then 10 mrem/hour. Greater than 10 mrem/hour samples are defined as "characterization samples" with expected surface dose rates in excess of 10 mrem/hour. Programs that were included in the assessment of "current and projected sampling and analytical needs" are as follows: single-shell tank (SST) waste characterization, waste tank safety issue resolution (assumes waste characterization analyses are performed on same samples as safety resolution analyses), 242-A evaporator feed characterization, grout feed characterization, grout vault core sampling, N and K basin sludge characterization and cleanout, soil remediation programs, SST interim stabilization and isolation, and Hanford Waste Vitrification Plant technology development.

18070 (WHC-SA-1343) **Destruction of ferrocyanide compounds found in the Hanford Site's radioactive waste.** Colby, S.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-71: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011334. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports the test results of candidate waste treatment processes to destroy nickel-ferrocyanide compounds contained in the Hanford Site's radioactive waste storage area. Candidate processes, including ozone oxidation, hydrogen peroxide oxidation, and calcination, were tested in the laboratory using a nonradioactive simulated waste. Ozone oxidation and calcination successfully destroyed the nickel-ferrocyanide. However, tests indicate that nickel-ferrocyanide is not easily destroyed using hydrogen peroxide. To determine the ozone/nickel-ferrocyanide oxidation rate, a laboratory scale prototype ozone reactor was employed. The prototype reactor provides excellent gas-liquid mass transport, which is envisioned to increase the overall nickel-ferrocyanide destruction rate. The analytical results indicate that 250 grams of ozone are required to oxidize 1 gram of nickel-ferrocyanide. At this reaction rate, the process would require excessively large quantities of ozone to process the waste at the Hanford Site. Efforts are currently underway to increase the reaction kinetics for the process. Finally, one processing option successfully demonstrated in the laboratory that encompass calcination not only destroys ferrocyanides, but also separates the transuranics from the bulk nonradioactive waste.

18071 (WHC-SA-1365) **Status of performance assessment studies for the disposal of low- level radioactive waste in the 218-W-5 Burial Ground, 200 West Area, Hanford Site.** Wood, M.I. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-70: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010708. Source: OSTI; NTIS; INIS; GPO Dep.

A performance assessment analysis is being performed at the Hanford Site to support the disposal of low-level waste. The analysis is required to achieve compliance with US Department of Energy Order 5820.2A, which states that a performance assessment analysis be submitted and approved for a particular disposal facility. Performance objectives defined in the order and other informal guidance are used to define the types of analyses and associated data collection tasks that must be completed to produce a satisfactory analysis. In this paper, the types of tasks being conducted at the Hanford Site are discussed and progress made in different areas is summarized.

18072 (WINCO-1090) **The glass-ceramic processing flowsheet for ICPP high-level waste: Status report.** Bolon, W.D. (comp.); Herzog, J.D.; Olson, A.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1991. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE92012106. Source: OSTI; NTIS; INIS; GPO Dep.

High-level liquid wastes (HLLW) are generated at the Idaho Chemical Processing Plant (ICPP) from the reprocessing of irradiated government nuclear fuels. The basic types of fuel reprocessed at the ICPP include those which are clad in aluminum, stainless steel, and zirconium. The HLLW is then solidified bed calciner at a temperature of 500°C in the New Waste Calcining Facility (NWCF). The calcined waste is stored near-surface in concrete encased stainless steel bins. A glass-ceramic waste form is being developed for immobilizing calcined high-level wastes (HLLW) prior to final disposal. Development work at the ICPP has included the formulation of experimental glass-ceramic waste forms to immobilize the calcined HLW, and the conceptualization of a process to produce the waste forms. Research has shown that a glass-ceramic waste form, with leaching properties comparable to a glass, could result in about 60% less immobilized waste volume as compared to a vitrified waste form. A conceptual process to produce a glass-ceramic waste form meeting the current preliminary regulatory durability requirements has been identified.

18073 (WINCO-1091) **BDAT vitrification of ICPP HLW.** Nelson, L.O. (comp.). Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1991. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE92011336. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho Chemical Processing Plant (ICPP) reprocesses spent nuclear fuel generated from US Navy operations and other DOE programs. In a typical operating year, approximately 1500 m^3 of acidic high-level liquid waste (HLLW) are generated. Since 1963 ICCP has been calcined in a fluidized bed at a temperature of 500 C to yield a granular solid (calcine). Approximately 3,500 m^3 of calcine is currently stored in site. ICPP calcine (and ICPP HLLW) are hazardous and radioactive substances. In accordance with 40 CFR 268, the RCRA land disposal restrictions (LDR), two primary compliance issues exist for calcine (and HLLW); treatment standards and storage. The LDR's mandate that hazardous waste be treated using the best-demonstrated available technology (BDAT). In the LDR standards issued May 8, 1990, EPA designates vitrification as the BDAT for mixed waste generated during the reprocessing of fuel rods. As the law currently stands and if no extensions are granted, BDAT (vitrification) must be applied to the ICPP starting on May 8, 1992. The purpose of this report is to give an analysis of how BDAT could be applied to ICPP HLW. Three options are discussed: vitrification of as-calcined HLW, vitrification of HLLW, and the use of SRS/West Valley/Hanford technology to neutralize and vitrify HLLW. Major unit operations and required research and development for each of the BDAT options are given and a discussion of glass waste form development and required future work are also presented.

18074 (WSRC-MS-91-009) **Glass melter off-gas system pluggages: Cause, significance, and remediation.** Jantzen, C.M. Westinghouse Savannah River Co., Aiken, SC (United

States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9104256–16: Symposium on nuclear waste management, Cincinnati, OH (United States), 28 Apr - 2 may 1991). Order Number DE92009875. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid high-level nuclear waste will be immobilized at the Savannah River Site (SRS) by vitrification in borosilicate glass. Experimental glass melters, used to develop the vitrification process, have occasionally experienced problems with pluggage of the off-gas line with solid deposits. The deposits were determined to be mixtures of alkali rich chlorides, sulfates, borates, and fluorides with entrained insoluble particles of Fe_2O_3 spinel, and frit. The distribution and location of the alkali deposits throughout the off-gas system indicate that the deposits form by vapor-phase transport and condensation. Condensation of the alkali-rich phases cements the entrained particulates causing the off-gas system pluggages. The identification of vapor phase transport as the operational mechanism causing off-gas system pluggages indicates that deposition can be effectively eliminated by increasing the off-gas velocity. The cementitious alkali borates, halides, and sulfates comprising the off-gas line deposits were determined to be water soluble. Thus pluggage can be effectively removed with water and/or steam.

18075 (WSRC-MS–91-050) **Design control for the Savannah River Site Consolidated Incineration Facility.** Walker, R.E. (Bechtel Savannah River, Inc., North Augusta, SC (United States)); Rider, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-910559–10: 10. annual international incineration conference: environmental concerns and controls, Knoxville, TN (United States), 13-17 May 1991). Order Number DE92010824. Source: OSTI; NTIS; GPO Dep.

The initiation, development, and control of the design for the Consolidated Incineration Facility at the US Department of Energy Savannah River Site has been, from the inception, a precisely and formally controlled process. A plan was developed and implemented to ensure output properly aligned with approved design criteria and conformed to applicable regulations throughout the design process. The key element of design control was the technical baseline which established the benchmark against which all changes to the design was evaluated. During the conceptual design phase of the project, design criteria were written to reflect the project objectives and functional requirements. Governmental regulations were reviewed to determine permitting and licensing actions required. Hazards assessments were performed to establish design classifications. The resulting design criteria, permitting requirements, and facility classifications were incorporated into the design plan which provided the basis for subsequent design activities. As the project proceeded through the various design phases, design control was maintained according to the design plan. Review of all design products was performed by the project team routinely. Formal independent design reviews were accomplished prior to releasing the design for construction. Alignment between criteria and design output was verified periodically throughout the design process. A formal design change control board was invoked to effect design changes impacting technical baselines. All changes to design initiated following issue for construction also were subject to procedural control.

18076 (WSRC-MS–91-407) **Biofouling of microfilters at the Savannah River Site F/H-Area Effluent Treatment Facility.** McCabe, D.J.; Wiggins, A.W.; Poirier, M.R.; Hazen, T.C. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920307–60: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011028. Source: OSTI; NTIS; INIS; GPO Dep.

The F/H-Effluent Treatment Facility uses state-of-the-art water treatment processes to remove contaminants from low-level radioactive wastewater at the Savannah River Site. The plant replaces seepage basins that were closed to comply with the 1984 amendments to the Resource Conservation and Recovery Act (RCRA). The facility removes both radioactive and nonradioactive contaminants from the effluents orginating from onsite waste management facilities. The unit processes involve filtration, ion exchange, activated carbon absorption, and reverse osmosis. The filtration step is prone to considerable fouling, reducing the overall throughput of the facility. The filters utilized in the process are Norton Ceraflo™ ceramic microfilters. It was discovered that bacteria were primarily responsible for the severe filter fouling. Inorganic fouling was also observed, but was not normally as severe as the bacterial fouling. The bacteria densities necessary to induce severe fouling were not significantly higher than those often found in surface water streams. Diversion of waste streams containing the highest quantity of bacteria, and various methods of source reduction were implemented, which dramatically improved the filter performance. Addition of aluminum nitrate at low pH further improved the filter performance.

18077 (WSRC-MS–91-560) **Statistical experimental design for saltstone mixtures.** Harris, S.P.; Postles, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920606–14: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92010634. Source: OSTI; NTIS; INIS; GPO Dep.

We used a mixture experimental design for determining a window of operability for a process at the Savannah River Site Defense Waste Processing Facility (DWPF). The high-level radioactive waste at the Savannah River Site is stored in large underground carbon steel tanks. The waste consists of a supernate layer and a sludge layer. ^{137}Cs will be removed from the supernate by precipitation and filtration. After further processing, the supernate layer will be fixed as a grout for disposal in concrete vaults. The remaining precipitate will be processed at the DWPF with treated waste tank sludge and glass-making chemicals into borosilicate glass. The leach rate properties of the supernate grout, formed from various mixes of solidified salt waste, needed to be determined. The effective diffusion coefficients for NO_3 and Cr were used as a measure of leach rate. Various mixes of cement, $Ca(OH)_2$, salt, slag and flyash were used. These constituents comprise the whole mix. Thus, a mixture experimental design was used.

18078 (WSRC-MS–92-017) **Hydrogen generation during treatment of simulated high-level radioactive waste with formic acid.** Ritter, J.A.; Zamecnik, J.R.; Hsu, C.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920430–74: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92011056. Source: OSTI; NTIS; INIS; GPO Dep.

The Integrated Defense Waste Processing Facility (DWPF) Melter System (IDMS), operated by the Savannah River Laboratory, is a one-fifth scale pilot facility used in support of the start-up and operation of the Department of Energy's DWPF. Five IDMS runs determined the effect of the presence of noble metals in HLW sludge on the H_2 generation rate during the preparation of melter feed with formic acid. Overall, the results clearly showed that H_2 generation in the DWPF SRAT could, at times, exceed the lower flammable limit of H_2 in air (4 vol%), depending on such factors as offgas generation and air inleakage of the DWPF vessels. Therefore, the installation of a forced air purge system and H_2 monitors were recommended to the DWPF to control the generation of H_2 during melter feed preparation by fuel dilution.

18079 (WSRC-MS–92-044) **Concrete disposal vaults: An alternative to Hazardous Waste/Mixed Waste earthen landfills.** Freitag, A.A.; Stewart, D.E.; Peterson, S.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920307–62: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011000. Source: OSTI; NTIS; GPO Dep.

The Hazardous Waste/Mixed Waste (HW/MW) Disposal Facility is a new facility planned for on site processing and disposal of existing and future solid hazardous and/or mixed wastes generated at Savannah River Site (SRS). The first phase of the project is the completion of engineered above grade concrete disposal vaults which are to be permitted as hazardous waste disposal facilities and designed in accordance with the Resource Conservation and Recovery Act (RCRA) and appropriate US Department of Energy (DOE) Orders. The RCRA minimum performance standards promulgated in 40 CFR 264 and 265 are based on double lined earthen landfills. The regulations allow for alternative design and operational practices provided that the alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous constituents into the groundwater or surface water at least as effectively as the specified double lined earthen system. The engineered concrete vault structure for SRS is designed to comply and/or exceed the performance standards of the RCRA regulations and the associated RCRA technical guidance documents issued by the US Environmental Protection Agency (EPA).

18080 (WSRC-MS-92-062) **Meeting performance objectives for Low-Level Radioactive Disposal Waste Facility at the Savannah River Site.** Taylor, G.E. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920307-64: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010993. Source: OSTI; NTIS; INIS; GPO Dep.

A new Low-Level Radioactive Waste (LLW) disposal facility at the Savannah River Site is presently being constructed. The facility was designed to meet specific performance objectives (derived from DOE Order 5820.2A and proposed EPA Regulation 40CFR 193) in the disposal of containerized Class A and B wastes. The disposal units have been designed as below-grade concrete vaults. These vaults will be constructed using uniquely designed blast furnace slag + fly as concrete mix, surrounded by a highly permeable drainage layer, and covered with an engineered clay cap to provide the necessary environmental isolation of the waste form to meet the stated performance objectives. The concrete mix used in this facility, is the first such application in the United States. These vaults become operational in September 1992 and will become the first active facility of its kind, several years ahead of those planned in the commercial theater. This paper will discuss the selection of the performance objectives and conceptual design.

18081 (WSRC-MS-92-063) **Development of high integrity, maximum durability concrete structures for LLW disposal facilities.** Taylor, W.P. (Main (Charles T.), Inc., Charlotte, NC (United States)). Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920307-68: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011102. Source: OSTI; NTIS; INIS; GPO Dep.

A number of disposal facilities for Low-Level Radioactive Wastes have been planned for the Savannah River Site. Design has been completed for disposal vaults for several waste classifications and construction is nearly complete or well underway on some facilities. Specific design criteria varies somewhat for each waste classification. All disposal units have been designed as below-grade concrete vaults, although the majority will be above ground for many years before being encapsulated with earth at final closure. Some classes of vaults have a minimum required service life of 100 years. All vaults utilize a unique blend of cement, blast furnace slag and pozzolan. The design synthesizes the properties of the concrete mix with carefully planned design details and construction methodologies to (1) eliminate uncontrolled cracking; (2) minimize leakage potential; and (3) maximize durability. The first of these vaults will become operational in 1992. 9 refs.

18082 (WSRC-RP-89-16) **Tests of a system to exclude roots from buried radioactive waste in a warm, humid climate.** Murphy, C.E. Jr. (Westinghouse Savannah River Co., Aiken, SC (United States)); Corey, J.C.; Adriano, D.C.; Decker, O.D.; Griggs, R.D. Westinghouse Savannah River Co., Aiken, SC (United States). [1989]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. (CONF-890854-16: 11. annual DOE low level waste management conference, Pittsburgh, PA (United States), 22-24 Aug 1989). Order Number DE92011178. Source: OSTI; NTIS; INIS; GPO Dep.

Vegetation is commonly used to stabilize the ground covering buried waste sites. However, constituents of buried waste can be brought to the surface if the waste is penetrated by plant roots. An ideal waste burial system would allow the use of vegetation to stabilize the soil above the buried waste but would exclude roots from the waste. One system that shows considerable promise is a slow release encapsulation of a root growth inhibitor (Trifluralin). Projected lifetimes of the capsule are in the order of 100 years. The capsule is bonded to a geotextile, which provides an easy means of distributing the capsule evenly over the area to be protected. Vegetation grown in the soil above the barrier has provided good ground cover, although some decrease in growth has been found in some species. Of the species tested the sensitivity to the biobarrier, as measured by the distance root growth stops near the barrier, is bamboo> bahia grass> bermuda grass> soybean. Potential uses for the biobarrier at the Savannah River Site (SRS) include the protection of clay caps over buried, low-level saltstone and protection of gravel drains and clay caps over decommissioned seepage basins. Trails of the biobarrier as part of waste site caps are scheduled to begin during the next 12 months.

18083 (WSRC-RP-89-842) **International technology exchange in support of the Defense Waste Processing Facility wasteform production.** Kitchen, B.G. Westinghouse Savannah River Co., Aiken, SC (United States). 23 Aug 1989. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-900406-90: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (United States), 8-12 Apr 1990). Order Number DE92011181. Source: OSTI; NTIS; INIS; GPO Dep.

The nearly completed Defense Waste Processing Facility (DWPF) is a Department of Energy (DOE) facility at the Savannah River Site that is designed to immobilize defense high level radioactive waste (HLW) by vitrification in borosilicate glass and containment in stainless steel canisters suitable for storage in the future DOE HLW repository. The DWPF is expected to start cold operation later this year (1990), and will be the first full scale vitrification facility operating in the United States, and the largest in the world. The DOE has been coordinating technology transfer and exchange on issues relating to HLW treatment and disposal through bi-lateral agreements with several nations. For the nearly fifteen years of the vitrification program at Savannah River Laboratory, over two hundred exchanges have been conducted with a dozen international agencies involving about five-hundred foreign national specialists. These international exchanges have been beneficial to the DOE's waste management efforts through confirmation of the choice of the waste form, enhanced understanding of melter operating phenomena, support for paths forward in political/regulatory arenas, confirmation of costs for waste form compliance programs, and establishing the need for enhancements of melter facility designs. This paper will compare designs and schedules of the international vitrification programs, and will discuss technical areas where the exchanges have provided data that have confirmed and aided US research and development efforts, impacted the design of the DWPF and guided the planning for regulatory interaction and product acceptance.

18084 (WSRC-RP-92-115) **Summary of aluminum nitrate tests at the F/H-ETF.** McCabe, D.J.; Wiggins, A.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92010987. Source: OSTI; NTIS; GPO Dep.

Biofouling of the Norton ceramic filters in the F/H Effluent Treatment Facility (ETF) has been minimized by bacterial control strategies on the influent streams. However, enough bacteria still exists in the routine influent to impact the filter performance. One method of remediating biofouling in routine influent, initially observed in laboratory tests on simulant solutions, involves addition of aluminum nitrate to the influent wastewater. Tests on actual feed at the ETF using aluminum nitrate showed significantly improved performance, with increases in filter permeability of up to four-fold compared to the baseline case. These improvements were only realized after modifications to the pH adjustment system were completed which minimized upsets in the pH of the feed solutions.

18085 (WSRC-TR--92-50) **Discrete event simulation of the Defense Waste Processing Facility (DWPF) analytical laboratory.** Shanahan, K.L. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1992. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013078. Source: OSTI; NTIS; INIS; GPO Dep.

A discrete event simulation of the Savannah River Site (SRS) Defense Waste Processing Facility (DWPF) analytical laboratory has been constructed in the GPSS language. It was used to estimate laboratory analysis times at process analytical hold points and to study the effect of sample number on those times. Typical results are presented for three different simultaneous representing increasing levels of complexity, and for different sampling schemes. Example equipment utilization time plots are also included. SRS DWPF laboratory management and chemists found the simulations very useful for resource and schedule planning.

18086 (Y/EN--4417) **Y-12 centralized sanitary landfill II closure/post-closure plan.** Oak Ridge Y-12 Plant, TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States); Main (Charles T.), Inc., Charlotte, NC (United States). 18 Oct 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400 ;AC05-91OR21928 ;AC05-90OR21870. Order Number DE92010983. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE--3027. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

The following text details closure and post-closures activities to be conducted at the Y-12 Centralized Sanitary Landfill II. The landfill is owned by the Department of Energy (DOE) and co-operated by Martin Marietta Energy Systems, Inc., under Tennessee Permit Number: SNL-01-103--0189. This plan has been prepared in accordance with Rule 1200-1-7 of Tennessee Department of Environment and Conservation (TDEC) Regulations, Solid Waste Processing and Disposal dated March 18, 1990. Engineered drawings for this project are identified as CAPE--3027.

18087 (Y/EN--4417/R1) **Y-12 centralized sanitary landfill II closure/post-closure plan: Revision 1.** Oak Ridge Y-12 Plant, TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States); Main (Charles T.), Inc., Charlotte, NC (United States). 24 Feb 1992. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400 ;AC05-91OR21928 ;AC05-90OR21870. (Y/EN--4575;Y/SUB--89-TN526V). Order Number DE92010985. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE--3028. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

The following text details closure and post-closure activities to be conducted at the Y-12 Centralized Sanitary Landfill II, a landfill for nonhazardous and nonradioactive wastes. This report describes containment, drainage, groundwater monitoring, methane gas monitoring costs, and quality assurance.

18088 (Y/EN--4418) **Y-12 Spoil Area 1 closure/post-closure plant.** Oak Ridge Y-12 Plant, TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States); Main (Charles T.), Inc., Charlotte, NC (United States). 18 Oct 1991. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400 ;AC05-91OR21928 ;AC05-90OR21870. Order Number DE92010981. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for the project are identified as CAPE--3026. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This document is the Closure and Post-Closure Plan for the Y-12 Spoil Area I at the US Department of Energy (DOE) Y-12 Plant in Oak Ridge, Tennessee. The Spoil Area is owned by the DOE and co-operated by Martin Marietta Energy Systems, Inc., under Tennessee permit No. DML-01-103-0012. This plant has been prepared in accordance with the Rule 1200-1-7, Solid Waste Processing and Disposal, promulgated under the authority of the Tennessee Department of Environment and Conservation (TDEC), with an effective date of March 18, 1990. Engineered drawings for this project are identified as CAPE-3026. The Y-12 Spoil Area I landfill is a permitted Class IV disposal facility that was operated under permit DML-01-103-0012, granted by the Tennessee Department of Health and Environment on January 15, 1986. The facility was used for the disposal of spoil materials consisting primarily of inert solid wastes (i.e., non-combustible and non-putrescible solid wastes) generated through maintenance, construction, demolition, and renovation projects at the Y-12 Plant. A list of the waste types placed in the facility is presented in Table 1.2-1. Liquids, hazardous wastes, or any types of special wastes as defined by the Tennessee Solid Waste Processing and Disposal regulations were not allowed to be disposed of in the facility. There were no reported operational problems during the active life of the facility.

18089 (YJT--90-06) **Transport and microstructural phenomena in bentonite clay with respect to the behavior and influence of Na, Cu and U.** Pusch, R. (Clay Technology Ab, Lund (Sweden)); Karnland, O.; Muurinen, A. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Apr 1990. 97p. Order Number DE92628339. Source: OSTI; NTIS (US Sales Only); INIS.

MX-80 Na smectite clay, essentially consisting of montmorillonite, was investigated with respect to major transport properties and rheological behavior. Diffusion and percolation tests using sodium, copper and uranium solutions were conducted both at room temperature and at 90 deg C. In the latter case the clay samples had been hydrothermally pretreated at 90 deg C and 10 - 20 MPa pressure for 10 days. The clay dry density was 0.8 and 1.8 g/cm^3 in most of the tests. The report gives the results of the diffusion, percolation and rheological studies and discusses about the transport and microstructural phenomena in bentonite. (orig.).

18090 (YJT--91-09) **Degradation modelling for the concrete silo in TVO's VLJ repository.** Alcorn, S.R. (RE/SPEC Inc, Albuquerque, New Mexico (USA)); Christian-Frear, T.L.; Wallace, M. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). May 1991. 79p. Order Number DE92628340. Source: OSTI; NTIS (US Sales Only); INIS.

Teollisuuden Voima Oy (TVO) is currendy construcing in Finland an underground repository (the VLJ repository) for storage of low- and intermediate-level radioactive wastes generated at the Olkiluoto (TVO I and TVO II) nuclear power plant. Intermediate level wastes will be emplaced inside a large concrete silo, which is the principal engineered barrier in the repository. The primary objective of the investigation is to develop an estimate of the length of time it will take for the silo to degrade due to interaction with groundwater to the point that it fails to perform as designed. A secondary objective is to develop a methodology to estimate the length of time required for radio nuclides to migrate from the region inside the silo through the silo wall and floor to the accessible environment as a function of cement and concrete properties. Chemical modeling techniques using the codes EQ3NR/EQ6 were employed to model the degradation of the repository concrete due to interaction with groundwater, and porous flow and diffusion modeling approaches were taken to: (1) estimate the time it would take groundwater and ions to travel into and out of the silo concrete, and (2) determine how these travel times change as the concrete degrades. The results of the investigation suggest that the hydraulic conductivity of the concrete will decrease over time because of the considerable net volume increase (net porosity decrease) from the chemical interactions. Therefore, it appears likely, based on the geochemical and mass transport models, that the silo win perform as required for at least its 500-year design life, and possibly much longer.

18091 (YJT--91-17) **Production methods and costs of oxygen free copper canisters for nuclear waste disposal.** Rajainmaeki, H. (Outokumpu Poricopper Oy, Pori (Finland)); Nieminen, M.; Laakso, L. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Aug 1991. 39p. Order Number DE92628341. Source: OSTI; NTIS (US Sales Only); INIS.

The fabrication technology and costs of various manufacturing alternatives to make large copper canisters for spent fuel repository are discussed. The capsule design is based on the TVO's new advanced cold process concept where a steel canister is surrounded by the oxygen free copper canister. This study shows that already at present there exist several possible manufacturing routes, which result in consistently high quality canisters. Hot rolling, bending and EB-welding the seam is the best way to assure the small grain size which is preferable for the best inspectability of the final EB-welded seam of the lid. The same route turns out also to be the most economical.

18092 (YJT–91-18) **Simfuel dissolution studies in granitic groundwater.** Casas, I. (MBT Technologia Ambiental CENT, Parc Technologic del Valles, Cerdanyola (Spain)); Caceci, M.S.; Bruno, J.; Sandino, A.; Ollila, K. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Sep 1991. 33p. Order Number DE92628342. Source: OSTI; NTIS (US Sales Only); INIS.

The dissolution behavior of an unirradiated chemical analogue of spent nuclear fuel (SIMFUEL) has been studied in the presence of two different synthetic groundwater at 25 deg C and under both oxic and anoxic conditions. The release of U, Mo, Ba, Y and Sr was monitored during static (batch) leaching experiments of long duration (about 250 days). Preliminary results from continuous flow-through reactor experiments are also reported. The results obtained indicate the usefulness and limitations of SIMFUEL in the study of the kinetics and mechanism of dissolution of the minor components of spent nuclear fuel. Molybdenum, barium and strontium have shown a trend to congruent dissolution with the SIMFUEL matrix after a higher initial fractional release. Yttrium release has been found to be solubility controlled under the experimental conditions. A clear dependence on the partial pressure of O_2 of the rates of dissolution of uranium has been observed.

18093 (YJT–91-23) **Suitability of geopolymeric concretes for nuclear waste disposal.** Ipatti, A. (Imatran Voima Oy, Helsinki (Finland)); Kallio, L. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Dec 1991. 36p. (In Finnish). Order Number DE92628344. Source: OSTI; NTIS (US Sales Only); INIS.

Concrete barriers are in essential role in most of the disposal concepts for nuclear waste. As to the binders, the used high-quality, strong and dense concretes may be based both on the present types of cements and on new types of special cements. One feasible special cement discussed in this literature report is the geopolymeric cement, which is, at its cleanest, a completely lime-free binder composed mainly of aluminium silicates. However, in 1990 the lime-free aluminium silicate cement had not yet reached the stage of development required of a widely marketed factory product. On the other hand, as an applicable product the development work started as early as in the 70s in France and in the USA has reached a blended cement consisting both of geopolymeric and Portland cements. The main advantages of the geopolymeric concrete compared to the ordinary Portland cement concrete are based on richer and stronger chemical bonds of the cement stone. The strong three-dimensional networks of bonds make the geopolymeric concrete stronger, denser and, above all, more ductile. The geopolymeric concrete is particularly suitable for hazardous waste applications, since hazardous materials have been found to be locked inside the geopolymeric networks. The properties of the geopolymeric cements and concretes and the implemented applications seem to be highly promising, but as to the nuclear waste applications there is not sufficient amount of reliable experimental information available yet. The domestic cement and concrete industry will be in key position in accumulation of information and operating experiences. (orig.).

18094 (Y/SUB/WM–099) **Y-12 Waste Management Division Process Waste Assessment (PWA) report.** Oak Ridge Y-12 Plant, TN (United States); Weston (Roy F.), Inc., Oak Ridge, TN (United States); International Technology Corp., Oak Ridge, TN (United States). Jan 1992. 131p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011439. Source: OSTI; NTIS; INIS; GPO Dep.

The Process Waste Assessment (PWA) methodology used by the Martin Marietta Energy Systems, Inc. (Energy Systems) Y-12 Waste Management Division (WMD) was based on the US Department of Energy (DOE) Model Process Waste Assessment Plan, which in turn, was based on the US Environmental Protection Agency, (US EPA) Waste Minimization Opportunity Assessment Manual but incorporated modifications suggested by various DOE production facilities. The DOE PWA plan methodology was slightly modified to meet the differing needs of WMD because the model was directed toward production operations versus waste treatment, storage, and disposal operations. The objective of this PWA was to compile information about the WMD operations and processes that transport, treat, store, and dispose of waste streams generated by other Y-12 organizations and WMD. Data were also collected on WMD operating procedures and WMD waste streams as well as other Y-12 organizations' waste streams managed. The assessment consisted of five primary steps: organization of the WMD PWA Team and subteams, assessment of WMD operations and waste streams, development and evaluation of waste minimization options, compilation, review, and publication of the PWA report and supporting data, and implementation of waste minimization options.

0530 Environmental Aspects

Refer also to citation(s) 17900, 17906, 17911, 17916, 17927, 17966, 18009, 18010, 18033, 18064, 18107, 19416, 19556, 19564

18095 (DOE-HMIP-RR–91.060) **Factual biosphere database for Sellafield and the surrounding area.** Broderick, M.A. (ANS Consultants Ltd., Epsom (United Kingdom)). Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Dec 1991. 107p. Contract PECD-7/9/191. (ANS–2595-R28.). Order Number DE92628022. Source: OSTI; NTIS (US Sales Only); INIS.

This report documents from open published sources a factual database appropriate to the Sellafield region including the coastal marine environment for present day biosphere conditions. A detailed description of the present day environment in the Sellafield area is provided. This includes a description of the natural environment and climate. Site specific data required for biosphere modelling are also outlined. (author).

18096 (DOE/ID–22099) **Transmissivity of perched aquifers at the Idaho National Engineering Laboratory, Idaho.** Ackerman, D.J. Geological Survey, Idaho Falls, ID (United States). 1991. 31p. Sponsored by USDOE, Washington, DC (United States); Department of the Interior, Washington, DC (United States). (USGS/WRI–91-4114). Order Number DE92012360. Source: OSTI; NTIS; U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225; GPO Dep.

Aquifer-test data of 43 single-well tests at 22 wells in perched aquifers at the Idaho National Engineering Laboratory were analyzed to estimate values of transmissivity. Estimates of transmissivity for individual wells ranged from 1.0 to 15,000 feet squared per day, more than 4 orders of magnitude. These data were determined in a consistent manner and are useful for describing the distribution of transmissivity at the Idaho National Engineering Laboratory. The results of type-curve analysis of eight tests at six wells were used to verify a regression relation between specific capacity and transmissivity. This relation, in turn, was used to analyze all specific-capacity data. Values of relative uncertainty for estimated values of transmissivity generally ranged from 0.1 order of magnitude for type-curve analysis to 0.5 order of magnitude for regression analysis and measured drawdown of less than 0.1 foot. The values of transmissivity given in this report represent the transmissivity near the test wells and within the test interval. Due to high degree of heterogeneity of the basalt and the unknown thickness of the aquifers, it is more likely the transmissivity of the whole basalt sequence is different from those values given in this report.

18097 (DPST–85-783) **Analysis of organics in 643-G groundwaters by GC/MS.** Hoeffner, S.L.; Denham, E.L.; Oblath, S.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 26 Sep 1985. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92013214. Source: OSTI; NTIS; GPO Dep.

Twenty-three of the 63 monitoring wells in the 643-G burial ground consistently contain measurable (> 1 ppm) amounts of total organic carbon, TOC. Of these 23 wells, 10 that contain elevated (2–400 ppm) TOC were chosen for in-depth analysis of semivolatile organics by gas chromatography/mass spectrometry, GC/MS. A well located near the site of previous decontamination operations was also chosen for analysis. About 40% of the organic compounds detected in these well waters have been identified. Many of these compounds are indicative of liquid scintillation wastes, spent solvent wastes, and solvent degradation products.

Four priority pollutants were present at low levels. Some of the organics identified are probably degradation products from humic substances. Organic compounds of unknown origin are also present. No strong chelators capable of increasing radionuclide mobility have been identified. Preliminary dialysis work indicates that up to 30–40% of the TOC may be present as nonvolatile humic substances that cannot be analyzed by GC/MS.

18098 (HAN–4113) **Tritium wastes.** Hanford Works, Richland, WA (United States). 21 Sep 1951. 1p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011860. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a letter which described the release of tritium into the atmosphere as a result of extraction activities at Hanford from the start of operations to July 1, 1951. The amount of tritium wastes which was released and stored, and the type of storage was given in this letter.

18099 (HW–32808) **Control of ground contamination.** Parker, H.M. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 19 Aug 1954. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011863. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Portions of the Hanford Reservation in 1954 had significant particulate contamination from the Redox process. This paper is about the methods used to decontaminate the Reservation. The two methods are decontamination and access control. A general description of the ideas and benefits of each method is given. (MB)

18100 (INIS-mf–13188) **Assessment of human health risk of reported soil levels of metals and radionuclides in Port Hope.** Ontario Ministry of the Environment, Toronto, ON (Canada); Ontario Ministry of Labour, Toronto, ON (Canada). Nov 1991. 124p. Order Number DE92626187. Source: OSTI; NTIS (US Sales Only); INIS.

Risk assessment methods are applied to the question of health implications of contaminated soil in the Port Hope area. Soil-related as well as other pathways of exposure are considered. Exposures to the reported levels of uranium, antimony, chromium, copper, nickel, cadmium, cobalt, selenium, and zinc in Port Hope soils are not expected to result in adverse health consequences. Oral exposure to arsenic in soil at the reported levels is estimated to result in incremental cancer risk levels in the negligible range (10^{-5}). Estimated exposures also fall well below suggested toxic thresholds for arsenic. For the two small areas within the >50 μg/g isopleth, assessment of exposure is difficult without more definitive data on soil concentrations in these zones. Contamination of soils with lead is overall quite limited. In general, the reported soil levels of lead are not anticipated to pose a hazard. The site with the highest concentrations of lead is located on the west bank of the Ganaraska River, a popular fishing area. Depending on the level and extent of contamination, as well as degree of contact with the site, potential exposures could exceed tolerable intakes for children. Exposures to the radionuclides Ra(226), Pb(210), and U(238) in soil at the reported levels are estimated to fall well within recommended population limits.

18101 (SKB-TR–91-41) **Individual doses from radionuclides released to the Baltic coast.** Bergstroem, U. (Studsvik AB, Nykoeping (Sweden)); Nordlinder, S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden); Studsvik AB, Nykoeping (Sweden). 7 May 1991. 34p. (STUDSVIK-NS–91-60.). Order Number DE92628031. Source: OSTI; NTIS (US Sales Only); INIS.

Individual doses to critical groups from a continuous unit release of nuclides from high-level waste to a coast area were calculated. The selection of nuclides for this study was based on experience of their importance from a radiological point of view. The coastal area should be representative for average conditions along the Swedish Baltic coast. The costal area was simulated in the model by compartments for water and sediment, respectively. Six exposure pathways for activity from the water and sediment reservoirs were considered. The ecosystem was assumed to be similar to present conditions in Sweden. This was also the case concerning diet and living habits. In addition, the doses from naturally occurring nuclides in the uranium decay chains were calculated, based on natural levels. The calculations were carried out with the BIOPATH and PRISM codes. The latter code was used to obtain the uncertainty in the results due to the uncertainty in the input parameter values. (au) (34 refs., 15 tbls.).

18102 (STRIPA-TR–91-20) **Site characterization and validation - excavation stress effects around the validation drift.** Tinucci, J.P. (Itasca Consulting Group Inc., Minneapolis, MN (United States)); Israelsson, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Aug 1991. 83p. Order Number DE92627870. Source: OSTI; NTIS (US Sales Only); INIS.

The results of previous numerical modelling studies to investigate excavation stress effects around the Site Characterization Validation (SCV) drift at the Stripa mine have been reviewed. Though three-dimensional fractures were not directly simulated in previous studies, estimates of stresses on fracture planes were made. This study examines the direct effect of fractures on excavation stresses around the site validation drift for the purpose of understanding how excavation-induced stress changes might influence fluid flow in fractures. Three-dimensional stress modelling was carried out using the discontinuum code 3DEC to determine the state of stress around the drift. Fractures were assumed to have linear elastic normal behavior and elastic perfectly-plastic shear behavior. Results suggest that fracture shear displacements are small enough to be elastic - that is, no significant slip was evident. Fractures from the major fracture sets generally tend to close immediately around the drift, while further in the wall rock they tend to slightly open as a result of the excavation. The presence of fractures produce stress distributions that differ little from continuum models and analytic solutions. The most important difference between the continuum and discontinuum models is that the fracture behavior results in a nonuniform distribution of stresses around the excavation. The effect of fractures on displacements is most pronounced in the highly fractured H-zone, which strikes nearly perpendicular to the drift. (au).

18103 (STRIPA-TR–91-22) **Distinct element modelling of joint behavior in nearfield rock.** Hoekmark, H. (Clay Technology AB, Lund (Sweden)); Israelsson, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1991. 129p. Order Number DE92627871. Source: OSTI; NTIS (US Sales Only); INIS.

The investigation reported here concerns numerical simulations of the behaviour of the jointed rock mass in the nearest surroundings Of a portion of a KBS3 type tunnel, including one deposition hole. Results from three-dimensional models are presented and compared to results obtained from previous investigations of two-dimensional models. The three-dimensional models and the previous two-dimensional models relate to conditions prevailing in and around the BMT drift in Stripa mine. In particular are the importance of conditions, implicitly assumed in two-dimensional models, regarding joint orientation and joint persistence, investigated. The evaluation of the results is focused on effects on joint apertures. The implications regarding rock permeability is discussed for a couple of cases. It is found that the real three-dimensional geometry is of great importance, and that the two-dimensional models in some cases tend to overestimate the magnitudes of inelastic joint displacements and associated aperture changes considerably, i.e. the real three-dimensional situation implies locking effects, that generally stabilizes the block assembly. It is recommended that further three-dimensional simulations should be performed to determine relevant ranges of alteration of fracture apertures, caused by excavation and thermal processes, and that fracture geometries, that are typical to virgin granitic rock, should be defined and used as input for these simulations. (au).

18104 (STRIPA-TR–91-25) **Site characterization and validation - equipment design and techniques used in single borehole hydraulic testing, simulated drift experiment and crosshole testing.** Holmes, D.C. (BGS Keyworth, Nottinghamshire (United Kingdom)); Sehlstedt, M. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Oct 1991. 131p. Order Number DE92627873. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the equipment and techniques used to investigate the variation of hydrogeological parameters within a fractured crystalline rock mass. The testing program was performed during stage 3 of the site characterization and validation programme at the Stripa mine in Sweden. This programme used a multidisciplinary approach, combining geophysical, geological and hydrogeological methods, to determine how groundwater moved through the rock mass. The hydrogeological work package involved three components. Firstly, novel single borehole techniques (focused packer testing) were used to determine the distribution of hydraulic conductivity and head along individual boreholes. Secondly, water was abstracted from boreholes which were drilled to simulate a tunnel (simulated drift experiment). Locations and magnitudes of flows were measured together with pressure responses at various points in the SCV rock mass. Thirdly, small scale crosshole tests, involving detailed interference testing, were used to determine the variability of hydrogeological parameters within previously identified, significant flow zones. (au).

0540 Health and Safety

Refer also to citation(s) 17893, 17900, 17906, 17907, 17911, 17912, 17914, 17915, 17916, 17939, 17949, 17953, 17954, 17956, 17971, 17983, 17984, 17985, 17986, 17987, 17997, 18005, 18006, 18015, 18034, 18039, 18045, 18049, 18056, 18066, 18079, 18080, 18086, 18087, 18088, 18098, 18099, 18432, 18617, 18619, 19079, 19531, 19875, 20502

18105 (BNL–47339) **Occupational dose reduction at Department of Energy contractor facilities: Study of ALARA programs: Status 1990.** Dionne, B.J.; Meinhold, C.B.; Khan, T.A.; Baum, J.W. Brookhaven National Lab., Upton, NY (United States). Mar 1992. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92012520. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides the US Department of Energy (DOE) and its contractors with information that will be useful for reducing occupational radiation doses at DOE's nuclear facilities. In 1989 and 1990, health physicists from the Brookhaven National Laboratory's (BNL) ALARA Center visited twelve DOE contractor facilities with annual collective dose equivalents greater than 100 person-rem (100 person-cSv). The health physicists interviewed radiological safety staff, engineers, and training personnel who were responsible for dose control. The status of ALARA practices at the major contractor facilities was compared with the requirements and recommendation in DOE Order 5480.11 "Radiation Protection for Occupational Workers" and PNL-6577 "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are as Low as Reasonably Achievable." The information and data collected are described and examples of successful practices are presented. The findings on the status of the DOE Contractor ALARA Programs are summarized and evaluated. In addition, the supplement to this report contains examples of good-practice documents associated with implementing the major elements of a formally documented ALARA program for a major DOE contractor facility.

18106 (CONF-920468–1) **The organization of ALARA program at a DOE facility.** Setaro, J.A. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From DOE ALARA workshop; Upton, NY (United States); 21-22 Apr 1992. Order Number DE92011784. Source: OSTI; NTIS; INIS; GPO Dep.

The organization of an ALARA Program at a DOE Facility (Oak Ridge National Laboratory), it's relationship with laboratory management, facility operators, and the radiation protection program is described. The use of chartered ALARA committees at two distinct levels is discussed.

18107 (DOE/EA–0468) **Final Environmental Assessment of remedial action at the Falls City uranium mill tailings site, Falls City, Texas.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office. Dec 1991. 118p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013378. Source: OSTI; NTIS; INIS; GPO Dep.

This environmental assessment (EA) is prepared pursuant to the National Environmental Policy Act (NEPA), which requires Federal agencies to assess the impacts that their actions may have on the environment. This EA examines the short- and long-term effects of the DOE's proposed remedial action for the Falls City tailings site. The no action alternative is also examined. The DOE will use the information and analyses presented here to determine whether the proposed action would have a significant impact on the environment. If the impacts are determined to be significant, an EIS will be prepared. If the impacts are not judged to be significant, the DOE will issue an official "Finding of No Significant Impact" and implement the proposed action.

18108 (DOE/EA–0476) **Installation and operation of the Plantwide Fire Protection Systems and related Domestic Water Supply Systems: Environmental Assessment.** USDOE Savannah River Operations Office, Aiken, SC (United States). Dec 1991. 33p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012181. Source: OSTI; NTIS; INIS; GPO Dep.

A safe work environment is needed to support the Savannah River Site (SRS) mission of producing special nuclear material. This Environmental Assessment (EA) assesses the potential environmental impact(s) of adding to and upgrading the Plantwide Fire Protection System and selected related portions of the Domestic Water Supply System at SRS, Aiken, South Carolina. The following objectives are expected to be met by this action: Prevent undue threat to public health and welfare from fire at SRS; prevent undue hazard to employees at SRS from fire; prevent unacceptable delay to vital DOE programs as a result of fire at SRS; keep fire related property damage at SRS to a manageable level;, and provide an upgraded supply of domestic water for the Reactor Areas. The Reactor Areas' domestic water supplies do not meet current demand capacity due to the age and condition of the 30-year old iron piping. In addition, the water quality for these supplies is not consistent with current SCDHEC requirements. Therefore, DOE proposes to upgrade this Domestic Water Supply System to meet current demand and quality levels, as well as the needs of fire protection system improvement.

18109 (DOE/EH–0246) **Tiger Team Assessment of the Oak Ridge K-25 Site.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Dec 1991. 792p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012238. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Special Projects in the Office of the Assistant Secretary for Environment, Safety, and Health (EH) has the responsibility to conduct Tiger Team Assessments for the Secretary of Energy. This report documents the Tiger Team Assessment of the Oak Ridge K-25 Site (K-25 Site), Oak Ridge, Tennessee. The purpose of the Assessment is to provide the Secretary of Energy with concise information on the: current ES&H compliance status of the Site and the vulnerabilities associated with that compliance status; root causes for noncompliance; adequacy of DOE and site contractor ES&H management programs; adequacy of response actions developed to address identified problem areas; and adequacy of ES&H self-assessments and the institutionalization of the self-assessment process at the K-25 Site.

18110 (DPST–74-533) **Estimation of ^{129}I distribution in SRP separations processes.** Comman, W.R. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 21 Nov 1974. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92013094. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum reviews available information on iodine behavior in the two SRP Separations Areas and provides a suggested distribution for ^{129}I in the processes. This radionuclide is difficult to measure in process streams because of its low energy (0.15 Mev β) and particularly, its low specific activity (1.7×10^{-4}Ci/g). Therefore, distribution has been inferred from data on the more radioactive ^{131}I; it is assumed that there is no isotopic fractionation of iodine in the processes.

18111 (UCRL-JC–109754) **Near-visible Raman instrumentation for remote multi-point process monitoring using optical**

fibers and optical multiplexing. Vess, T.M.; Angel, S.M. Lawrence Livermore National Lab., CA (United States). Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920124–22: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92011287. Source: OSTI; NTIS; GPO Dep.

A portable Raman instrument is presented which measures spectra simultaneously from 10 separate fiber-optic probes. The instrument is being developed for a number of applications including multi-point process monitoring and characterizing mixed waste tanks.

18112 (WHC-SA–1471) **Proposed use of a variable geometry truss manipulator for radioactive waste removal from underground storage tanks.** Salerno, R.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mechanical Engineering); Robertshaw, H.H.; Millsap, W.J.; Horner, C.G.; Bennett, D.W. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307–73: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92012201. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Hanford Site's single-shell tank waste problem and some proposed requirements for a waste retrieval manipulator are described. A proposed variable geometry truss (VGT) manipulator is described. The kinematic configuration of the VGT join and the kinematics of the manipulator are discussed. The developmental needs to field a working manipulator are described.

18113 (WSRC-MS–92-060) **Regulatory requirements of the Integrated Technology Demonstration Program, Savannah River Site.** Bregren, C.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920307–63: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010994. Source: OSTI; NTIS; GPO Dep.

The integrated demonstration program at the Savannah River Site (SRS) involves demonstration, testing and evaluation of new characterization, monitoring, drilling and remediation technologies for soils and groundwater impacted by organic solvent contamination. The regulatory success of the demonstration program has developed as a result of open communications between the regulators and the technical teams involved. This open dialogue is an attempt to allow timely completion of applied environmental restoration demonstrations while meeting all applicable regulatory requirements. Simultaneous processing of multiple regulatory documents (satisfying RCRA, CERCLEA, NEPA and various state regulations) has streamlined the overall permitting process. Public involvement is achieved as various regulatory documents are advertised for public comment consistent with the site's community relations plan. The SRS integrated demonstration has been permitted and endorsed by regulatory agencies, including the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control. EPA headquarters and regional offices are involved in DOE's Integrated Demonstration Program. This relationship allows for rapid regulatory acceptance while reducing federal funding and time requirements.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 19012, 19090

18114 (LA–12278-MS) **Information display for nuclear materials safeguards.** Stanbro, W.D.; Hunteman, W.J.; Leonard, R.S.; Mullen, M.F.; Prommel, J.M.; Whiteson, R. Los Alamos National Lab., NM (United States). Apr 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011488. Source: OSTI; NTIS; GPO Dep.

This report describes the results of a study of ways to improve the presentation of data from facilities for safeguards purposes. A major conclusion of this work is that effective presentation begins with a "data fusion" process that combines information from multiple sources. The report illustrates this with a conceptual design for a safeguards information system.

18115 (LA–12309-MS) **Plutonium isotopic abundance measurements on CBNM NRM 271 analyzed with the FRAM and MGA codes.** Friar, R.J.; Sampson, T.E. Los Alamos National Lab., NM (United States). May 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92012170. Source: OSTI; NTIS; GPO Dep.

We report results of gamma-ray spectroscopy measurements of the isotopic distributions of plutonium in the reference-material set CBNM NRM 271 as analyzed by the FRAM and MGA plutonium isotopic codes. We acquired high-quality spectral data under measurement conditions approximating field-use conditions recommended by the code developers. Bias and precision results from these measurements are presented for both codes. Both codes performed very well for these measurements. These standards have proven to be very useful for testing the Los Alamos FRAM code in the high-burnup region where well-characterized materials have been unavailable at Los Alamos.

18116 (LA-UR–92-883) **Precision of gamma-ray measurements of the effective specific power and effective ^{240}Pu fraction of plutonium.** Sampson, T.E. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9203123–1: International workshop on calorimetry, Ispra (Italy), 23-27 Mar 1992). Order Number DE92011269. Source: OSTI; NTIS; INIS; GPO Dep.

This paper uses gamma-ray spectrometry data from replicate measurements on 40 plutonium-bearing samples to examine the repeatability of the effective ^{240}Pu fraction ($^{240}Pu_{eff}$) and the effective specific power (P_{eff}) calculated from the isotopic distribution analyzed with gamma-ray spectrometry codes. The measurements were used to identify the error component arising from repeatability in the determination of the isotopic composition of plutonium in the sample and the contribution of the error component to the uncertainty in total plutonium mass measurements from neutron coincidence counting ($^{240}Pu_{eff}$) and calorimetry (P_{eff}). The 40 samples had $^{240}Pu_{eff}$ percentages ranging from 2 to 39% and P_{eff} values ranging from 2 to 16 mW/g Pu. Four different gamma-ray spectrometry codes (FRAM, MGA, Blue Box, and PUJRC) were used to analyze the data (not all samples were analyzed with each code). All analyses showed that the % relative standard deviation of P_{eff} was smaller than that of $^{240}Pu_{eff}$. This result coupled with a cursory examination of uncertainties in coincidence counting of well-characterized samples and water-bath calorimetry errors for the same types of samples lead to the conclusion that smaller uncertainties will be present in the total plutonium mass determined by the combination of calorimetry/gamma-ray spectrometry than in the mass determined by coincidence counting/gamma-ray spectrometry. An additional examination of the biases arising from the ^{240}Pu correlation used in the gamma-ray spectrometry codes also supported this conclusion. 17 refs.

18117 (NBL–326) **New Brunswick Laboratory progress report, October 1990–September 1991.** USDOE New Brunswick Lab., Argonne, IL (United States). Mar 1992. 70p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012529. Source: OSTI; NTIS; GPO Dep.

The mission of the New Brunswick Laboratory of the US Department of Energy (DOE) is to provide and maintain a nuclear material measurements and standards laboratory as a technical response to DOE's statutory responsibility to assure the safeguarding of nuclear materials. This report summarizes the mission-fulfilling activities of the New Brunswick Laboratory for the period of October 1990 through September 1991.

0560 Legislation and Regulations

Refer also to citation(s) 17950, 18347, 18348, 18350, 18351, 19090, 20631, 20632

18118 (AECB-C-36) **A guide to the licensing of uranium and thorium mine and mill waste management systems: Proposed regulatory guide.** Atomic Energy Control Board, Ottawa, ON (Canada). 2 Jun 1986. 114p. (In English, French). Order Number DE92627123. Source: OSTI; NTIS (US Sales Only); INIS.

This document is issued to assist industry and the public in understanding the licensing process used by the Canadian Atomic Energy Control Board (AECB), and do describe and consolidate the requirements, criteria and guidelines the AECB uses in the regulation of uranium and thorium mine and mill waste management systems. All phases of these systems are addressed, including pre-development activities, siting and construction, operation, and decommissioning and abandonment.

18119 (DOE/OR/21555-T3) **Report of the Attorney General to the Safe Growth Cabinet Council.** Cody, W.J. Tennessee Office of the Attorney General, Nashville, TN (United States). 23 Sep 1985. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011924. Source: OSTI; NTIS; GPO Dep.

On January 7, 1983, President Reagan signed into law the Nuclear Waste Policy Act (NWPA), 42 U.S.C. § 10101 et seq. As part of the Act, the Congress of the United States authorized construction of a permanent deep geologic repository in an effort to solve the nation's problem with disposal of spent nuclear fuel and high-level radioactive waste. Congress also directed the Department of Energy (DOE) to study the need for and feasibility of constructing a monitored retrievable storage (MRS) facility. Also in late April of 1985, the State of Tennessee was informed that three potential sites for the MRS had been selected in Tennessee. The locations included the site of the abandoned Clinch River Breeder Reactor Project, a site on DOE's Oak Ridge Reservation, and the site of the abandoned Hartsville nuclear power plant. This report covers the legal aspects of the potential project completed during the period September 1, 1985–November 30, 1985.

18120 (DOE/OR/21555-T3-Suppl.) **Supplemental report of the Attorney General to the Safe Growth Cabinet Council.** Wurz, R.T. Tennessee Office of the Attorney General, Nashville, TN (United States). 7 Jan 1986. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85OR21555. Order Number DE92011925. Source: OSTI; NTIS; GPO Dep.

In February of 1986, the Department of Energy (DOE) will present to Congress a proposal to construct a Monitored Retrievable Storage facility (MRS) in Tennessee. This report is a listing of the comments received regarding the MRS plan.

18121 (INIS-mf-13150) **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal: Final Act.** United Nations Environmental Programme. Mar 1989 91p. Order Number DE92627124. Source: OSTI; NTIS (US Sales Only); INIS.

The Conference on Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous Wastes was convened by the Executive Director of the United Nations Environment Programme (UNEP) pursuant to decision 14/30, adopted by the Governing Council of UNEP on 17 June 1987. The Conference adopted the Global Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. In the 29 articles of this Convention the definitions of hazardous wastes, the scope of the Convention, general obligations of the signatory parties, transboundary waste movement between Parties as well as through states which are not parties, illegal traffic, international control, liabilities, financial aspects, verification, accession and withdrawal of the Parties are defined in detail. There are 6 Annexes, including specifications of hazardous wastes, information requirements, notification rules, etc.

18122 (INIS-mf-13183, pp. 42) **Calculation of activities and dose rates due to lead test assemblies.** Ross-Jones, B. (Electricity Supply Commission, Johannesburg (South Africa)); De Klerk, P.; Sartori, D. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. LEAD/dose rates; CASKS; COMPUTER CALCULATIONS; FUEL RODS; LEAD; PERSONNEL; Q CODES; RADIATION HAZARDS; RADIOACTIVE MATERIALS; S CODES; SPENT FUELS; TEST FACILITIES

18123 (WHC-EP-0539) **Regulatory analysis of the Underground Storage Tank-Integrated Demonstration Program.** Smith, E.H. Westinghouse Hanford Co., Richland, WA (United States). [1992]. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012161. Source: OSTI; NTIS; INIS; GPO Dep.

The Underground Storage Tank-Integrated Demonstration (UST-ID) Program has been developed to identify, demonstrate, test, and evaluate technologies that will provide alternatives to the current underground storage tank remediation program. The UST-ID Program is a national program that consists of five participating US Department of Energy (DOE) sites where technologies can be developed an ultimately demonstrated. Once these technologies are demonstrated, the UST-ID Program will transfer the developed technology system to industry (governmental or industrial) for application or back to Research and Development for further evaluation and modification, as necessary. In order to ensure that the UST-ID Program proceeds without interruption, it will be necessary to identify regulatory requirements along with associated permitting and notification requirements early in the technology development process. This document serves as a baseline for identifying certain federal and state regulatory requirements that may impact the UST-ID Program and the demonstration of any identified technologies.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

18124 (INFO-0102-5) **Probabilistic consequence assessment of hydrogen sulphide releases from a heavy water plant: Addendum and summary.** Baynes, C.J. (Monserco Ltd., Mississauga, ON (Canada)). Atomic Energy Control Board, Ottawa, ON (Canada). May 1986. 78p. Order Number DE92626780. Source: OSTI; NTIS (US Sales Only); INIS.

This report provides a summary of work carried out on behalf of the Atomic Energy Control Board, concerned with the consequences of accidental releases to the atmosphere of hydrogen sulphide (H_2S) at a heavy water plant. In this study, assessments of consequences are made in terms of the probabilities of a range of possible outcomes, i.e., numbers of fatalities, given a certain release scenario. The report describes the major features of a computer model which was developed to calculate the consequences and their associated probabilities, and the major input data used in applying the model to a consequence assessment of the Bruce heavy water plant (HWP) in Ontario. The results of the sensitivity analyses of the model are summarized. Finally, the results of the consequence assessments of 43 accidental release scenarios at the Bruce HWP are summarized, together with a number of conclusions which were drawn from these results regarding the predicted consequences and the factors which influence them.

0702 Radiation Sources

Refer also to citation(s) 18393, 18394, 19048, 19338

18125 (INFO-0281) **Industrial gamma radiography: Study guide for the qualified operator examination.** Atomic Energy Control Board, Ottawa, ON (Canada). 1989. 202p. (In English, French). Order Number DE92626790. Source: OSTI; NTIS (US Sales Only); INIS.

French version included.

This is a study guide for individuals preparing to write the Atomic Energy Control Board's qualified operator examination on radiation safety in industrial radiography.

18126 (INIS-mf–13183, pp. 45) **Dose distributions in lineal energy associated with high energy monoenergetic neutrons.** Binns, P.J. (National Accelerator Centre, Faure (South Africa)); Hough, J.H. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIATION DOSE DISTRIBUTIONS/neutrons; CALIBRATION; DOSIMETRY; ENERGY; KERMA; NAC CYCLOTRON; NEUTRON BEAMS; NEUTRON FLUENCE; NEUTRON THERAPY; PROPORTIONAL COUNTERS; NEUTRONS; SPECTRA; TIME-OF-FLIGHT METHOD

18127 (INIS-mf–13183, pp. 43) **A computer program to calculate dose-volume histograms in interstitial brachytherapy.** Van der Woude, S. (Tygerberg Hospital, Bellville (South Africa). Dept. of Medical Physics); Pistorius, S. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIOTHERAPY/computer calculations; COMPUTER CODES; FORTRAN; IMPLANTS; MICROCOMPUTERS; RADIATION DOSE DISTRIBUTIONS; RADIATION DOSES; RADIOTHERAPY; SIEVERT UNIT

18128 (KFK–4794) **The AGATE-2 pilot plant.** Baumann, W.; Paur, H.R. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Schadstoffbeherrschung in der Umwelt (PSU). Dec 1991. 95p. (In German). Order Number DE92511580. Source: OSTI; NTIS (US Sales Only); INIS.

The Electron Beam Dry Scrubbing (EBDS) process is a dry method for the simultaneous removal of NO_x and SO_2 from flue gas. The test plant AGATE-2 was constructed in the year 1989 at the Nuclear Research Center in Karlsruhe. The main R and D goals at this plant are the improvement of energy efficiency of the EBDS and the optimization of the aerosol filtration. The test plant and the main components spray cooler, electron accelerator, filter technology, measurement techniques and control system are described in detail. (orig.).

18129 (OEFZS–4610) **Applications of stable isotope analysis in foodstuffs surveillance and environmental research.** Pichlmayer, F.; Blochberger, F. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Dec 1991. 19p. Order Number DE92626791. Source: OSTI; NTIS (US Sales Only); INIS.

The instrumental coupling of Elemental Analysis and Mass Spectrometry, constituting a convenient tool for isotope ratio measurements of the bioelements in solid or liquid samples is now well established. Advantages of this technique compared with the so far usual wet chemistry sample preparation are: speed of analysis, easy operation and minor sample consumption. The performance of the system is described and some applications are given. Detection of foodstuffs adulterations is mainly based on the natural carbon isotope differences between C_3- and C_4-plants. In the field of environmental research the existing small isotopic variations of carbon, nitrogen and sulfur in nature, which depend on substance origin and history, are used as intrinsic signature of the considered sample. Examples of source appointment or exclusion by help of this natural isotopic tracer method are dealt with. (authors).

18130 (OEFZS–4611) **Continuous non contacting control of the degree of admission of filler rods.** Frevert, E.; Markowitsch, P.; Volkmann, W. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Dec 1991. 22p. (In German). Order Number DE92626792. Source: OSTI; NTIS (US Sales Only); INIS.

In laboratory tests a method was found to control continuously and non-contacting the degree of admission of filler rods. Behind the filling station the absorption of the ionizing radiation of a ^{90}Sr beta source is measured. After successful tests with the laboratory equipment on the manufacturing machine of filler rods a prototype plant was constructed. The calibration is made by setting the measuring value of the empty filler rod equal to 0% and the measuring value of the optimum degree of admission equal to 100%. Between these two joints a scale is calculated so that to each measuring value a degree of admission can be assigned. The measuring time is 1 s. The limits of the allowable degrees of admission are freely adjustable. The construction of the plant is described. (authors).

18131 (UCRL–102612) **X-ray production experiments on the RACE Compact Torus Accelerator.** Hammer, J.H.; Eddleman, J.L.; Hartman, C.W.; McLean, H.S.; Molvik, A.W.; Gee, M. Lawrence Livermore National Lab., CA (United States). Dec 1989. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-8911130–15: 11. US/Japan workshop on field-reversed configurations and compact toroids, Los Alamos, NM (United States), 7-9 Nov 1989). Order Number DE92011851. Source: OSTI; NTIS; INIS; GPO Dep.

The Purpose of the Compact Torus Accelerator (CTA) program at LLNL is to prove the principle of a unique accelerator concept based on magnetically confined compact torus (CT) plasma rings and to study applications. Successful achievement of these goals could lead to a high power-density driver for many applications including an intense x-ray source for nuclear weapons effects simulation and an inertial fusion driver. Fusion applications and a description of the CTA concept are included in a companion paper at this conference. This paper will describe the initial experiments on soft x-ray production conducted on the plasma Ring ACcelerator Experiment (RACE) and compare the results to modeling studies. The experiments on CT stagnation and soft x-ray production were conducted with unfocused rings as a first of CT dynamics and the physics of x-ray production. The x-ray fluences observed are consistent with expectations based on calculations employing a radiation-hydrodynamics code. We conclude with a diffusion of future x-ray production studies that can be conducted on RACE and a possible multi-megajoule upgrade.

0703 Isotopic Power Supplies

Refer also to citation(s) 18678

0705 Health and Safety

Refer also to citation(s) 18124

0707 Regulation and Licensing

Refer also to citation(s) 20632

08 HYDROGEN

0801 Production

Refer also to citation(s) 17872

0802 Storage, Transport, and Handling

Refer also to citation(s) 18915

18132 (WSRC-MS–90-82) **The effect of hydrogen isotopes and helium on the tensile properties of 21-6-9 stainless steel.** Morgan, M.J.; Lohmeier, D. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9004146–10: 16. DOE compatibility, aging and service life conference, Livermore, CA (United States), 24-26 Apr 1990). Order Number DE92010700. Source: OSTI; NTIS; GPO Dep.

High-energy-rate-forged (HERF) stainless steels are used as the materials of construction for pressure vessels designed for the containment of hydrogen and its isotopes. Hydrogen and helium, the decay product of tritium, are known to embrittle these materials.

HERF stainless steels have a relatively good resistance to hydrogen-and-helium-induced embrittlement when compared to annealed stainless steels due to their high number density of dislocations, which act as traps for hydrogen and helium. However, the degree of embrittlement in these materials can vary considerably because of microstructure and yield strength variations introduced during the forging process. In this study the effect of hydrogen and tritium on the tensile properties of 21-6-9 stainless steel was measured as a function of HERF yield strength in the range of 660 to 930 MPa. The effect of microstructure was studied also be conducting tensile tests with HERF and annealed samples.

09 BIOMASS FUELS

Refer also to citation(s) 18633, 18671, 18728

18133 (NUTEK-B--92-1) **IEA Bioenergy. Annual report 1991.** NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). Jan 1992. 64p. Order Number DE92506587. Source: OSTI; NTIS (US Sales Only).

This report gives a summary of the work within the IEA Bioenergy Agreement during 1991. The report describes the work in the Executive Committee and also includes short progress reports from different Annex Tasks within the IEA Bioenergy Agreement. The Annex Tasks during the period 1989-91 were: Task V, Improvement of Energy-Dedicated Biomass Systems; Task VI, Biomass Supply from Conventional Forestry; Task VII, Improvement of Methods for Conversion of Biomass Feedstocks. In September 1991 the IEA Bioenergy Executive Committee approved a new R and D programme for the period 1992-94. The cooperative work will be performed within four new Tasks: Task VIII, Efficient and Environmentally-Sound Biomass Production Systems; Task IX, Harvesting and Supply of Wood Biomass for Energy; Task X, Biomass Utilization; Task XI, The Conversion of Municipal Solid Waste Feedstock to Energy. The structure and content of the new Tasks are also briefly described in the report.

18134 (SV-UB--91-66) **Biofuel based methanol and ethanol as fuels - a survey study.** Ekstroem, C. (Vattenfall Utveckling AB, Vaellingby (Sweden)); Stroem, E.; Bengtsson, A.; Brandberg, Aa. Vattenfall Utveckling AB, Vaellingby (Sweden). 25 Nov 1991. 62p. (In Swedish). Order Number DE92506571. Source: OSTI; NTIS (US Sales Only).

This study has been carried out with the purpose of describing some future possibilities for the utilization of biofuel based methanol and ethanol as fuels. When utilized as fuels in engines, gas turbines or boilers, methanol and ethanol give good and environmentally sound combustion performance resulting in less emissions of nitrogen oxides and unburnt mutagenous species than conventional fuels like gasoline or oils. Possible sulphur and dust/ash produced from the raw material is taken care of within the manufacturing process. If biofuels are used as a raw material, the net emissions of carbon dioxide will also be eliminated. The high degree of refinement makes alcohol fuels much more expensive than e.g. natural gas, oils or solid fuels. Methanol and ethanol produced from wood fuels cost at least about 0.40 SEK/kWh delivered to the consumer if the price of the raw material is about 0.10 SEK/kWh. Ethanol produced from cereals costs about 0.60 SEK/kWh and the potential for production in Sweden will be limited by the market for byproducts (feed) to maximum 150000 m^3/year. (All costs and prices are without taxes). Alcohol fuels may be competitive mainly for utilization in vehicles. Introduction of biofuel based vehicle fuels would mean that the transportation sector will compete in terms of biomass utilization. The fuel costs relative to gasoline/diesel oils have been estimated to about 1.5-2/2-3 for ethanol and methanol from wood fuels. Possible driving forces for an introduction of alcohol vehicle fuels in Sweden are very stringent environmental restrictions/fees and/or tax credits for the desired fuels. 54 refs., 10 figs., 15 tabs.

0907 Resources

Refer also to citation(s) 18144, 18646

18135 (CONF-9103215--, pp. 2-6) **Book review - Biomass Energy Project Development Guidebook.** Vranizan, J.M. (Carroll, Hatch and Associates, Inc., Portland, OR (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

In 1985 the Pacific Northwest and Alaska Biomass Energy Program sponsored the writing of a biomass energy project development guidebook. Subject matter included the following topics: Planning for Fuel Supply; Fuel Characteristics, Storage and Use; Selecting an Energy Conversion Process; Conversion Technologies; Environmental Considerations; Economics of Biomass Projects; Financing Biomass Projects; Plant Specific Specifications; Contracting for Fuel; Wood Residue Recovery, Collection and Processing; Small to Medium Sized Modular Combustion Systems; Agricultural Residues. Also included were case studies of biomass energy projects and a glossary.

18136 (CONF-9103215--, pp. 143-149) **More energy wood from forestry operations through integrated harvesting and multi-products processing.** Lambert, M.B. (Dept. of Agriculture, Portland, OR (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Abundant supplies of forest biomass that could potentially be used for energy wood are not being accessed because of marginal economics, inadequate harvest methods, and restrictive land management practices. Future forestry objectives may impose even more restrictive conditions. Improvements in efficiency and effectiveness of harvest methods, marketing, and bureaucratic processes may, however, render more energy wood while meeting new post-harvest stand conditions. Some improvements have been achieved while others lie on the horizon.

18137 (CONF-9103215--, pp. 198-199) **Michigan's Wood Energy Demonstration Project.** Nicholls, D. (Michigan State Univ., East Lansing (United States)); Potter-Wetter, K.; Huber, H.A. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Although wood is the major biomass energy source in Michigan, by many measures it is underutilized. Michigan's Wood Energy Demonstration Project (WEDP) is designed to help establish energy systems, providing model demonstration sites for other organizations. Specific objectives of the WEDP include identifying innovative wood energy technologies for industries and institutions, developing diverse demonstration sites, and evaluating operating data from these wood energy systems. A primary goal of the program is to transfer practical information to individuals and organizations interested in pursuing wood energy projects.

18138 (CONF-9103215--, pp. 200) **Biomass estimation and measurement techniques.** Reutebuch, S.E. (Dept. of Agriculture Forest Service, Portland, OR (United States)); Shainsky, L.J. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept.

of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The Biomass and Energy Research Work unit of the Pacific Northwest Research Station is conducting research to improve techniques for estimating and measuring forest biomass parameters. One such endeavor is the development of the FIBER model. FIBER is a computer program that estimates the volumes and weights of various components of a stand using taper and wood density equations and stand and utilization criteria supplied by the user. Volume and weight estimates for energy products are generated along with estimates for traditional wood uses. The FIBER model can be used to predict the allocation of total forest biomass for on-site and off-site products. Research is also underway to develop more efficient methods for measuring logging residues in cutover units.

18139 (CONF-9103215–, pp. 202-203) **Ethanol fuels for a secure future.** Overend, R.P. (Solar Energy Research Inst., Golden, CO (United States)); Hinman, N.; Bull, S. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The production of alternative transportation fuels such as ethanol and methanol from biomass can potentially replace a major fraction of the gasoline consumed in the US. The author illustrates a system based on dedicated crop production and advanced applications of biotechnology to produce ethanol.

18140 (CONF-9103215–, pp. 203) **Biomass energy - An environmentally preferred and sustainable option.** Chase, C.L. (Biomass Energy Systems and Energy Resource Management, Bellevue, WA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A display was presented that focuses on the Congressional mandates of: matching local resources to local energy needs; technology transfer and technical information assistance; resource assessments; environmental impact identification; pollution abatement and mitigation; and local economic development. Program activities in the Pacific Northwest are highlighted and technical projects are briefly described.

18141 (CONF-9103215– xii-xiii) **Bioenergy in the United States.** Davis, J.M. (Dept. of Energy, Washington, DC (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This presentation describes current and future problems related to energy usage in the United States; i.e., urban air pollution, dwindling national resources, global climate change, rural economic development, and reliance on imported oil. An analysis of the costs and benefits of the use of biomass fuels is presented. Uses and costs of ethanol fuels are presented in detail.

18142 (CONF-9103215– xviii-xxiii) **Status of wood energy applications.** Zerbe, J.I. (Dept. of Agriculture Forest Products Lab., Madison, WI (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

In this address, the potential of wood and wood residues to supply future energy needs is examined. In addition, the possible environmental impact of the use of wood fuels on global climate change is discussed. Technologies for the development of new fuels are described.

18143 (NEI-DK–785) **Information activities at the department of biotechnology 1990.** Reffstrup, T.; Ravn, T. Bioteknisk Inst., Kolding (Denmark). 1990 38p. (In Danish, English). Order Number DE92506304. Source: OSTI; NTIS (US Sales Only).

A collection of papers used as the basis of the same number of informative lectures delivered at the Institute of Biotechnology, Kolding, Denmark. The subjects of the lectures are hemicellulose extraction from straw and xylose fermentation, storage and wet separation of whole crops for biorefineries, the industrial uses of winter corn and the impact of such factors as soil, straw species, fertilizers and climate curing etc. on the combustion propertie of straw. (AB).

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Refer also to citation(s) 18135, 18139, 18155

18144 (CONF-9103215–, pp. 7-18) **Estimation of agricultural crop bioenergy resource availability in Kansas.** Nelson, R.G. (Kansas State Univ., Manhattan (United States)); Schrock, M.D. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This paper provides a methodology for estimating the amount of agricultural crop residue that can be removed for energy purposes without adversely affecting soil productivity. The agricultural crops considered in this study were corn (irrigated and dryland), grain sorghum (irrigated and dryland) and wheat (irrigated and continuously cropped). Computer programs (ACRRE and ACRWE) were developed to simulate the effect of residue removal on field soil loss due to these erosive processes. Evaluation of residue availability was based on limiting soil loss (tons/acre/year) resulting from either rainfall or wind erosion. The analysis was performed on each soil type not found to be highly erodible in each county in Kansas. The quantity of crop residue that can be removed without exceeding the tolerable limit for soil loss is strongly influenced by geographic location, soil type (physical characteristics), and cultural practices. Equivalent erosion protection provided by each of the crops is directly related to the quantity of residue that can be removed. Available biomass from the three crops considered varies from 0 to roughly 72 percent of the above-ground crop residue produced.

18145 (CONF-9103215–, pp. 19-21) **Hawaii Integrated Biofuels Research Program.** Phillips, V.D. (Univ. of Hawaii, Honolulu (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry,* *farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The Hawaii Natural Energy Institute at the University of Hawaii is conducting research on the production and conversion of biomass resources to gaseous and liquid fuels and other high value coproducts. The Hawaii Integrated Biofuels Research Program, presently in its fourth year of funding by the U.S. Department of Energy via the Solar Energy Research Institute, features basic and applied research on biomass resource assessment and crop production, thermochemical and biochemical conversion technology, and biomass systems integration and economics. This paper outlines the program's research accomplishments and future plans for developing superior integrated bioenergy systems to establish a viable biomass industry in Hawaii, with related potential for the United States and elsewhere.

18146 (CONF-9103215–, pp. 22-26) **Methodology study: Co-generation feasibility at sawmills.** Host, J. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This report discussed the various factors that should be studied and evaluated before establishing a cogeneration plant. The results of three case studies and a survey of energy needs in smaller and medium size sawmills are also presented. In general, cogeneration is feasible for supplying electric energy required for processing logs using fuelbark and other residues from the manufacturing process. A rebuilt turbine-generator unit is an initial cost saving alternative that is advantageous throughout the life of the operation.

18147 (CONF-9103215–, pp. 27-32) **Feasibility study of wood-fired cogeneration at a wood products industrial park Belington, WV.** Vasenda S.K. (West Virginia Univ., Morgantown (United States)); Hassler, C.C. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This feasibility study was conducted to determine if a wood-fired cogeneration system is a cost effective source of electricity for 12 companies located within and near a wood products industrial park in Belington, WV. Data was collected from each company regarding the amount and characteristic of residue generated, and quantity and cost of electricity and natural gas usage. Amount of residue generated by all companies included in the study was estimated at 161 tons/day, of which approximately 97 percent is above 40 percent moisture content (wet basis). Size of facility was based upon amount of residue generated and determined to be 2.5 MW. Capital cost was estimated to be $4.3 million, and annual operation/maintenance cost was estimated to be $422,000 for the first 5 years, and $502,000 thereafter. Savings of electricity and natural gas was estimated at $179,513 and $381,163, respectively. Avoided cost rate and MARR (minimum accepted rate of return) were altered in a cash flow analysis. Feasibility at a 4-year discounted payback period with NPV of S5,439,203 based upon 20-years was realized at 10 percent MARR and an avoided cost rate of $0.05023.

18148 (CONF-9103215–, pp. 117-122) **Winter rapeseed oil as a renewable fuel for the United States.** Auld, D.L. (Univ. of Idaho, Moscow (United States)); Peterson, C.L.; Korus, R.A. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Production of winter rapeseed and Canola is expected to increase rapidly over the next few years in the US. The University of Idaho, in cooperation with the Dept. of Energy's Herbaceous Energy Crops program, has conducted research since 1985 to identify potential production areas in this country where rapeseed could be grown as a source of BIODIESEL. Because of the severe winters in the northern tier of states, spring cultivars are best adapted in that area. Across much of the center of the country, conventional biennial cultivars have produced good seed yields. In the southeast, winter cultivars could optimize production. Endurance engine tests have shown that BIODIESEL (methyl ester of industrial rapeseed oil) was equivalent to diesel in both engine performance and durability. Commercial production of Canola and rapeseed crops could create a tremendous reservoir of vegetable oil which could be processed and used as BIODIESEL to provide a biologically renewable, environmentally friendly source of liquid fuel.

18149 (CONF-9103215–, pp. 200) **Firewood recovery using the tractor mounted Farmi winch.** Biltonen, T. (Univ. of Idaho, Moscow (United States)); Lee, H. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

All logging operations produce large volumes of leftover material. Disposal of this residue presents a large economic burden to the small forest landowner. Previous work estimates that for a selective harvest anywhere from three to five cords per acre of three inch and above material is left after cutting. Utilization of this residue could greatly increase a small private forest landowner's disposable income. The small forest landowner needs a method of recovering this otherwise wasted resource. This proposal describes this problem and the work required to determine the feasibility of recovering this residue with a farm tractor and skidding winch.

18150 (CONF-9103215–, pp. 201) **Cost to deliver sweet sorghum fermentables to a central plant.** Cundiff, J.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The major obstacle to a sweet sorghum-for-ethanol industry in the Piedmont of Virginia is the short harvest season of eight weeks. A Piedmont harvesting system is described that will enable the Piedmont to compete with Louisiana in production of sweet sorghum for ethanol. The cost to supply feedstock (up to the point fermentation begins) for a one million GPY ethanol plant was estimated to be $2.35/gal expected ethanol yield. This amount compared favorably with two other options.

18151 (NYSERDA–92-2) **Wood biomass: The potential of willow: Progress report, November 1987–December 1990.** White, E.H. (State Univ. of New York, Syracuse, NY (United States). Coll. of Environmental Science and Forestry); Abrahamson, L.P. New York State Energy Research and Development Authority, Albany, NY (United States); State Univ. of New York, Albany, NY (United States). Research Foundation. Oct 1991. 109p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; INIS; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

Experiments were established in central New York State in spring, 1987, to evaluate the potential of Salix for wood biomass production using ultrashort-rotation intensive-culture techniques. Five selected willow clones and one hybrid poplar clone planted at 1 × 1 foot spacing were tested for biomass production with annual coppicing. This report presents results of this research as of December 31, 1990. (VC)

0909 Processing

Refer also to citation(s) 18135, 18143, 18145, 18181, 18213, 18279

18152 (CONF-9103215–, pp. 92-95) **Wood gasification in new-lands agricultural development in Alaska.** Tomlin, D.C. (USDI Bureau of Indian Affairs, Anchorage, AK (United States)); Burton, W.E. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Wood gasification was proposed as an alternative to the bulldoze and burn method of land clearing in the Point MacKenzie Agricultural Development Project near Anchorage. The proposed pilot-plant demonstration would have used the predominantly birch timber from 400 acres of land per year to generate all of the energy used by the project, and still would have had to sell an average 65 kilowatts per minute of surplus energy, for about 250 days per year.

18153 (CONF-9103215–, pp. 63) **Biomass energy applications in the Southeast.** Badger, P. (Tennessee Valley Authority, Muscle Shoals, AL (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The use of wood for energy is the number one use of wood in the US. Eight of the top 10 industrial wood using states are located in the Southeast United States with Georgia the number one state. Approximately 50 percent of these facilities are in the primary and 40 percent in the secondary forestry industry. Approximately 90 percent of these facilities generate steam. Facilities range from large paper plants to furniture plants to schools, prisons, and hospitals. A case study of a veneer plant that uses a thermal oil heat transfer medium instead of steam is discussed. Thermal oil has several advantages including freeze protection, open (unpressurized) systems, no corrosion, no water treatment, no 'boiler' operator requirements, and lower maintenance costs. Initial thermal oil system costs are comparable to steam systems.

18154 (CONF-9103215–, pp. 129-132) **Ethanol production from refuse-derived waste using dilute sulfuric acid hydrolysis.** Barrier, J.W. (Tennessee Valley Authority, Muscle Shoals, AL (United States)); Bulls, M.M.; Shipley, T.M. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A dilute sulfuric acid hydrolysis process has been evaluated in laboratory studies using several refuse-derived feedstocks including refuse-derived fuel (RDF) and newsprint. Based on the results of these studies, preliminary technical and economic evaluations have been conducted to determine the commercial potential of the technology. This report gives the results of these evaluations.

18155 (CONF-9103215–, pp. 133-137) **Performance of a low temperature anaerobic digester.** Safley, L.M. Jr. (North Carolina State Univ., Raleigh (United States)); Westerman, P.W. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

An earthen digester was constructed to treat the separated liquids from flushed dairy cattle manure. A floating cover was used to harvest the biogas produced. Satisfactory digester performance was found for both winter and summer conditions. However, biogas production was found to fluctuate seasonally with reduced biogas production being noted during the winter. Mean methane yield was found to be 0.39 m^3 CH_4/kg VS added. Mean biogas concentration was 68.7 percent CH_4 and 28.2 percent CO_2. The loading rate during the period of study (10/31/88-12/17/91) was 0.12 kg VS/m^3-day.

18156 (CONF-9103215–, pp. 196-197) **At last, an affordable commercial boiler that burns wet biomass as cleanly as oil and gas.** Dobson, L. (Northern Light Research and Development, Seattle, WA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Over the past 16 years, Northern Light Research and Development has built 11 highly efficient and clean burning biomass combustion systems. Official emissions testing, by Bonneville/EPA, of a residential-size prototype showed that green wood can be burned as cleanly as gas and oil. Particulate emissions were 0.228 grams per hour, 1/33rd of the 1990 EPA non-catalytic woodstove laboratory emissions standard (using well-seasoned lumber), 1/65th of the average state-of-the-art catalytic woodstove emissions in recent field studies, and 1/3 of the cleanest pellet burner yet tested. This particulate emissions level is 0.0076 grains/dry standard cubic foot, one quarter of Washington's stringent Best Available Control Technology standard, which is attainable with present systems only by installing expensive cyclone separators, bag-house filters, and electrostatic precipitators. The prototype described above was tested with no stack clean-up equipment, electric fans or controls. In the same test, carbon monoxide emissions over a two hour test period were four parts per million, which is 1/7500th of the Federal Auto Emissions standard, 1/100th of the gas industry's standard for 'CO-Free Combustion,' and 1/2 of the EPA's standard for acceptable 24 hours indoor air quality.

18157 (CONF-9103215–, pp. 197-198) **Implementing a pellet fuel pilot project on LIHEAP.** Whitney, G. (Washington State Energy Office, Olympia (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This paper describes how an Energy Service Company (ESCO) can operate much like a utility to incorporate pellet fuel into the federal LIHEAP (Low-Income Heating Energy Assistance Program) program. In FY'89, LIHEAP provided over $1.3 billion to the states to be spent on the energy bills of the program's low-income clients. The vast majority of these funds was spent with traditional fuel providers such as natural gas and electric utilities, firewood, fuel oil, and propane vendors. LIHEAP budgets are being stretched as qualified applicants outnumber actual recipients by a three to one margin. Lower cost pellet fuels provided through an ESCO arrangement, which includes financing, installation, and maintenance services, can help address this problem. The ESCO would be paid on a dollar/MMbut basis for the space heating it provides.

18158 (CONF-9103215–, pp. 199) **Wood pellet feedstock drying system.** Fleischman, G. (Idaho Dept. of Water Resources, Boise (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

An innovative and cost-effective system for drying wood pellets is described. Used alfalfa dryers were purchased that run on dried sawdust after the warm-up period. The dryer also has a secondary combustion chamber which burns fines recycled from the dryer tube. The system compared favorably with commercially available units in efficiency and particulate emissions but with much reduced capital and operating costs.

18159 (ENET–8900006/1) **Power generation using refuse dump gas on the Cholwald refuse dump.** Kaiser, C.J.; Kaeslin, M. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). 1991. 17p. (In German). Order Number DE92515358. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The creation of refuse dump gas, its collection and analysis is described in this article, as well as its combustion in a gas motor with combined power generation. Details of the construction costs and operating experience are given. These are extremely positive. After initial difficulties, power generation has been increased steadily. The availability of the systems reached a level of over 97% in 1988 and power generation comprised 2.3% of the power produced by the Nidwalden Electricity Works (own production + external power). figs., tabs.

18160 (ENET–8900653-2) **Modular system for discontinuous methanization, phase I 'planning': Volume 2: file of the examined installations.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Jul 1990. 156p. (In French). Order Number DE92515347. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The data sheets from 26 systems for discontinuous methanisation are presented in this article. The systems are from Germany, France, Italy, Portugal, Switzerland and Spain. The details comprise the cattle numbers, the agricultural equipment, the bio gas equipment with flowsheet as well as the operating figures of the equipment.

18161 (Juel–2518) **Ethanol production with immobilized zymomonas mobilis in a fluidized-bed reactor.** Weuster-Botz, D. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Biotechnologie; Karlsruhe Univ. (T.H.) (Germany). Sep 1991. 152p. (In German). Order Number DE92511498. Source: OSTI; NTIS (US Sales Only).

The reaction experiments were carried out in specially developed, autoclavable 2.2 l laboratory-scale fluidized-bed reactors and in 55 l or 50 l semi-industrial fluidized-bed reactors. For the purpose of process control, an on-line polarimeter was implemented for the glucose substrate and an on-line gas chromatograph for the product ethanol, and a PC was used as process computer. (orig./EF).

18162 (NEI-DK–801) **Dry anaerobic decomposition of previously sorted domestic wastes and manures.** Bioplan Miljoekonsulenter ApS, Viborg (Denmark). [1992] 109p. (In Danish). Contract TR-88.1217. Order Number DE92506336. Source: OSTI; NTIS (US Sales Only).

In Denmark it is becoming increasingly common that household wastes are sorted at the source (that it to say that separate containers are provided for different kinds of domestic wastes) instead of being sorted mechanically after collection. Sorting at the source results in wastes that can be put to agricultural uses. Manure from chickens constitues a problem as it has a very high dry matter content which is not compatible to a conversion plant in which the biomass is continually stirred. Yet there is a growing demand for the development of biomass conversion plants adapted to poultry manure. This manure gives problems also because of its ammonium content. The aim of the project was to investigate whether decomposition of chicken manure is possible, and to which extent it would be necessary to use additives in the form of straw or paper etc. Potentials for the conversion of mink manure and previously sorted houshold wastes. The laboratory invetigations are described in detail and the text is illustrated with graphs, diagrams and tables. (AB) 46 refs.

18163 (NEI-DK–805) **Increased concentration of fibers in biomass converstion plants that ferment liquid manures from pigs.** Krueger-Bigadan A/S, Soeborg (Denmark). Jun 1991 10p. (In Danish). Contract TR-89.0277. Order Number DE92506335. Source: OSTI; NTIS (US Sales Only).

Liquid manures from pigs often have a relative low content of dry matter. Biomass conversion plants that ferment such manures can thus operate with quite short time periods without overloading. This also gives a reduction in the conversion of fibers that take a long time to ferment. Experiments with separation and return transmission of fiber from pig manures containing 4.5 dry matter, within a biomass conversion plant that operates under mesophile conditions and with a hydraulic process time period of 10 days, showed an increased concentration of dry matter in the reactor of between 4.8 and 8.4%. At the same time the methane yield was increased by 10% from 0.26 to 0.29 Nitrogen per cubic meter CH_4/kg VS. (AB).

18164 (NEI-DK–825) **Measurement of VFA as a process parameter in biogas reactors.** Sandberg, M.; Ahring, B. Dansk Teknologisk Inst., Taastrup (Denmark). Bioteknik. Nov 1991 74p. (In Danish). Contract ENS-1383/90-0001. Order Number DE92506372. Source: OSTI; NTIS (US Sales Only).

EFP-90.

The aim was to evaluate individual volatile fatty acids for their suitability for use in the identification of unbalance in biogas reactors. It was sought to find the acids the concentration of which increases after accidents which lead to unbalance, which were most significantly changed in concentration during unbalance, and which increased in concentration under all forms of unbalance. Tests were made under controlled laboratory conditions, process data from larger plants were evaluated for purposes of comparison, the influence of the individual concentration in the limitation of the biomass conversion process was clarified by batch tests, and information was culled from relevant literature on unbalance and the interrelations of sub-processes of anaerobic digestion. These subprocesses, in other words the interaction of bacteria groups in a balanced anaerobic digestion process producing methane from organic wastes, are described in considerable detail. Graphs, tables and diagrams illustrate the text. (AB) 27 refs.

18165 (SNV–3982) **Biological gasification of household waste: Technology development in Europe.** Ekwall, K. (Svenska Renhaallningsverksfoereningen, Malmoe (Sweden)); Ahl, N. National Environmental Protection Agency, Solna (Sweden); Svenska Renhaallningsverksfoereningen, Malmoe (Sweden). 1991. 104p. (In Swedish). Contract RV–91-10. Order Number DE92506576. Source: OSTI; NTIS (US Sales Only).

Biological gasification of household wastes is a relatively novel technique, and means that easily decomposable organic material is broken down to (primarily) methane and carbon dioxide, under anaerobic conditions with the aid of a mixed population of microorganisms. In this report 10 different processes are described, compared, and commented upon.

18166 (VTT-TIED–1306) **Forest chip cleaning.** Seppaenen, V. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Laboratory). Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 57p. (In Finnish). Order Number DE92506496. Source: OSTI; NTIS (US Sales Only).

The coal of the project was to develop cleaning method for whole-tree chips made of birch and pine. The wood loss should be as small as possible and the bark content less than 2 %. The new cleaning system has been planned on the basis of experiments, supplemented with earlier knowledge. The cleaning system consists of grinding of the whole-tree chips followed by multi-stage segregation process for clean chips and bark fractions. A lot of wood containing bark fraction is recycled to the grinding to decrease wood loss. Experiments have been made partly in laboratory scale and partly in pilot-scale. The result has been calculated on the basis of the separate experiments. The bark content of cleaned chips is 0.5-1 %. The wood loss in the birch whole-tree chips over 7 mm fraction is 20 % and in pine whole-tree fraction 12 %. The wood contains also branchwood. The yield of wood can be as high as 150 % compared to merchantable stemwood. The costs of the wood-chip cleaning have been estimated to be about 12 FIM/m^3 (solid). As a whole it has been estimated, that the cost of pulp chips from small-sized trees harvested by chip cleaning method are 80 FIM/m3 lower than by traditional cord wood method. Additional studies on the economy, the wood loss and bark content of the method are required before full-scale plant. The method is suitable for all wood chip cleaning purposes.

18167 (WAOENG–90-07) **1990 Washington State directory of biomass energy facilities.** Deshaye, J.A.; Kerstetter, J.D. Washington State Energy Office, Olympia, WA (United States). [1990]. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-89CE26597. Order Number DE92011829. Source: OSTI; NTIS; GPO Dep.

This second edition is an update of biomass energy production and use in Washington State for 1989. The purpose of this directory is to provide a listing of known biomass users within the state and some basic information about their facilities. The data can be helpful to persons or organizations considering the use of biomass fuels. The directory is divided into three sections of biomass facilities with each section containing a map of locations and a data summary table. In addition, a conversion table, a glossary and an index are provided in the back of the directory. The first section deals with biogas production from wastewater treatment plants. The second section provides information on the wood combustion facilities in the state. This section is subdivided into two categories. The first is for facilities connected with the forest products industries. The second category include other facilities using wood for energy. The third section is composed of three different types of biomass facilities – ethanol, municipal solid waste, and solid fuel processing. Biomass facilities included in this directory produce over 64 trillion Btu (British thermal units) per year. Wood combustion facilities account for 91 percent of the total. Biogas and ethanol facilities each produce close to 800 billion Btu per year, MSW facilities produce 1845 billion BTU, and solid fuel processing facilities produce 2321 billion Btu per year. To put these numbers in perspective, Washington's industrial section uses 200 trillion Btu of fuels per year. Therefore, biomass fuels used and/or produced by facilities listed in this directory account for nearly 32 percent of the state's total industrial fuel demand. This is a sizable contribution to the state's energy needs.

18168 **Ethanol sensor for computerized fermentation control.** Meiering, A.G.; Subden, R.E. 1 Sep 1991. Filed date 1 Mar 1990. Canada Patent patent application 2011297. 30p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An apparatus and method for determining and controlling the ethanol concentration and parameters of a fermentation broth are provided. The apparatus includes a probe having a slim cylindrical elongated stem with an enlarged housing located at the top of the stem. That housing contains a printed circuit board and a semiconductive ethanol sensor. A recessed side portion is located in the stem near its bottom. A gas-permeable tube connected to a predetermined gas flow is located in the recessed side portion. The outlet gas flow from the gas-permeable tube is connected to the inlet of the ethanol sensor which is electrically connected to the printed circuit board. A temperature sensor is located on the stem in the vicinity of the gas-permeable tube and is electrically connected to an electrical outlet on the housing. That electrical outlet provides an electrical connection from the printed circuit board to a microcomputer which is provided with data regarding the diffusion rate of ethanol through the gas-permeable tube as a function of temperature. The microcomputer, using special software and the data from the printed circuit board outlet and from the temperature and ethanol sensors, can continuously and accurately determine the actual ethanol concentration in the fermentation broth and display these data. 1 fig.

0910 Properties and Composition

Refer also to citation(s) 18135, 18182

18169 (CONF-9103215–, pp. 198) **The advantages of cubes, a non-traditional biomass fuel.** Tomlie, R. (Warren and Baerg Manufacturing, Dinuba, CA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Problems facing many co-generation facilities range from transportation to fugitive combustion to emissions and dust control. Briefly this paper addresses these problems. With many biomass fuels (planer shavings, sander dust, cotton gin trash, shredded newsprint, dried sewage sludge, bark, wheat straw and turkey shavings) transportation costs become prohibitive at weights of four to twelve pounds per cubic foot. Densification in the cube form usually results in weights of twenty-eight to thirty-two pounds per cubic foot, bulk density, thereby increasing the payload for transportation up to seven times. Nearly all the above mentioned fuels create fugitive combustion problems in fluidized bed, traveling grate or spreader stoker type boilers. Harmful emissions can be greatly reduced - to below detectable limits set by the EPA - with the addition of calcium hydroxide as a binder. Results of tests conducted by the EPA at Argonne National Lab on coal and waste paper densified together with CaOH as a binder have been published by the University of North Texas and are extremely encouraging in the problem areas of sulfur dioxide, tetra-chlorinated dioxins, tetrachlorinated furans, polyaromatic hydrocarbons and polychlorinated biphenyls.

0920 Combustion

Refer also to citation(s) 18143, 18156, 18206, 18207

18170 (CONF-9103215–, pp. 152-162) **An experimental investigation of wood combustion.** Dadkhah-Nikoo, A. (Oregon State Univ., Corvallis (United States)); Bushnell, D.J. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This paper presents the results from an experimental investigation of wood combustion. Variables chosen for investigation are fuel moisture content, fuel particle size, excess air, fraction and temperature of under-fire air. Influence of the off-design (part load) operation of the combustion unit on combustion efficiency and particulate emission is also investigated. Data recorded during the experiments include the composition and temperature of the combustion products, particulate emissions and combustible fraction of the particulate. Based on the experimental data, a linear regression model was developed to investigate the variables affecting the combustion process. A computer model was used to calculate the temperature and composition of the combustion products under adiabatic conditions. Results of the adiabatic model and the experimental regression analysis are compared and discussed. According to the results presented, it is concluded that the combustion efficiency and particulate emissions are most influenced by the factors that increase the volume of the combustion products in the combustion chamber. These variables include excess air, moisture content of the fuel and the combustion air temperature. Fuel particle size and the fraction of under-fire air did not significantly affect the combustion efficiency and particulate emissions. It is also concluded that the off-design (part load) operation of the combustion unit, results in higher particulate emissions and lower combustion efficiency.

18171 (CONF-9103215–, pp. 170-173) **The University of Idaho wood-fired boiler: A case study.** Kirkland, L.A. (Univ. of Idaho, Moscow (United States)); Steinhagen, H.P.; Campbell, A.G. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The University of Idaho recently converted its campus steam generating plant from natural gas to wood residue fuel. The combustion system typically burns chipped or hogged wood fuel 2 in. or less in size, at 35-50% moisture content (wet basis). Predried fuel was used initially, but the fines fraction caused operating and emission problems. High-quality, low-moisture content fuel purchased at minimal cost during the summer is currently blended with wet hog fuel during the winter when steam loads are high. Despite some design Limitations, the wood-fired unit nets fuel cost savings of several hundred thousand dollars a year.

18172 (CONF-9103215–, pp. 174-177) **Experimental investigation of the optimal operating conditions for wood pellet fuel combustion.** Haluzak, C. (Hewlett-Packard, Corvallis, OR (United States)); Dadkhah-Nikoo, A.; Bushnell, D.J. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Fourteen pellet samples from 5 states - Alaska, Washington, Oregon, Idaho, and Montana - were analyzed for a large number of physical and chemical variables. These variables included higher heating value, moisture content, ultimate analysis, etc. Combustion experiments were conducted using 9 of the available 14 wood pellets. The overall objective was to burn wood biomass pellets under 'reasonable' operating conditions and report the relative combustion performance of each fuel. The combustion experiments coupled with the pellet analysis data supported the following conclusions: (1) It was possible to construct a simple mathematical model describing the simultaneous effects of under- and over-fire air on pellet efficiency performance. The model was used to predict the optimal firing conditions based on thermal efficiency. (2) Tests indicate that all 9 of the relatively diverse wood pellet fuels behave similarly under similar operating conditions. (3) Carbon monoxide and oxides of nitrogen never reached mean values of over 215 ppm for all experiments. (4) Fuel-bound salt was found to cause relatively large particulate fly ash and opacity readings and resulted in the only grate-ash and slag formation.

18173 (CONF-9103215–, pp. 186-194) **Co-firing biomass and fossil fuels.** Junge, D.C. (Univ. of Alaska, Anchorage (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

In June 1989, the Alaska Energy Authority and the University of Alaska Anchorage published a monograph summarizing the technology of co-firing biomass and fossil fuels. The title of the 180 page monograph is 'Use of Mixed Fuels in Direct Combustion Systems'. Highlights from the monograph are presented in this paper with emphasis on the following areas: (1) Equipment design and operational experience co-firing fuels; (2) The impact of co-firing on efficiency; (3) Environmental considerations associated with co-firing; (4) Economic considerations in co-firing; and (5) Decision making criteria for co-firing.

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 18136, 18139, 18141, 18146, 18147, 18150, 18173, 18201, 18202, 18203, 18809

18174 (CONF-9103215–, pp. 33-38) **Market dynamics of biomass fuel in California.** Delaney, W.F. (Mason, Bruce and Girard, Inc., Portland, OR (United States)); Zane, G.A. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The California market for biomass fuel purchased by independent power producers has grown substantially since 1980. The PURPA legislation that based power purchase rates upon the 'avoided cost' of public utilities resulted in construction of nearly 900 Megawatts of capacity coming online by 1991. Until 1987, most powerplants were co-sited at sawmills and burned sawmill residue. By 1990 the installed capacity of stand-alone powerplants exceeded the capacity co-sited at wood products industry facilities. The 1991 demand for biomass fuel is estimated as 6,400,000 BDT. The 1991 market value of most biomass fuel delivered to powerplants is from $34 to $47 per BDT. Biomass fuel is now obtained from forest chips, agriculture residue and urban wood waste. The proportion of biomass fuel from the wood products industry is expected to decline and non-traditional fuels are expected to increase in availability.

18175 (CONF-9103215–, pp. 40-42) **Waste reduction: Energy and materials choices.** Kerstetter, J.D. (Washington State Energy Office, Olympia (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The use of energy to supply consumer products and to meet our basic energy needs is reviewed from the perspective of the available options and the implications of choosing those options. Waste reduction is shown to be an advantageous choice and several examples are given.

18176 (CONF-9103215–, pp. 80-85) **Production costs for SRIC Populus biomass.** Strauss, C.H. (Pennsylvania State Univ., University Park (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID

(United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Production costs for short rotation, intensive culture (SRIC) Populus biomass were developed from commercial-sized plantations under investigation throughout the US. Populus hybrid planted on good quality agricultural sites at a density of 850 cuttings/acre was projected to yield an average of 7 ovendry (OD) tons/acre/year. Discounted cash-flow analysis of multiple rotations showed preharvest production costs of $14/ton (OD). Harvesting and transportation expenses would increase the delivered cost to $35/ton (OD). Although this total cost compared favorably with the regional market price for aspen (Populus tremuloides), future investments in SRIC systems will require the development of biomass energy markets.

18177 (CONF-9103215–, pp. 86-91) **Cost to deliver sweet sorghum fermentables to a central mill.** Cundiff, J.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg, (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Cost to provide readily fermentable feedstock (juice sugar) and silage for fiber conversion, up to the point fermentation begins, was determined for three harvesting systems: forage chopper, pith combine (forage chopper modified to leave a 10 percent rind-leaf fraction in the field), and Piedmont system (allows for 30 to 60 days whole-stalk storage before processing). Costs were $1.06/gal for the forage chopper system, $1.06/gal for the pith combine, and $1.16 for the Piedmont system. The most optimistic projection of ethanol yield from fiber conversion (100 gal/dry ton) was used. No opportunity was identified for a significant reduction in feedstock cost; consequently, current market value of ethanol must increase before a sweet sorghum-to-ethanol industry in the Piedmont will be economically viable.

18178 (CONF-9103215–, pp. 96-103) **The economic impacts of federal tax reform for investments in short-rotation forest plantations.** Siegel, W.C. (Dept. of Agriculture Forest Service, New Orleans, LA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

In discussing the potential contributions of short-rotation forest plantations to the fuel wood supply, a number of economic factors have been considered and analyzed. Very little, however, has been written on the income tax aspects of the subject. The tax treatment of such plantings is an extremely important factor. The federal income tax, in particular, can have a significant impact on production costs and is a major factor in determining the economic feasibility of this type of investment. The major federal income tax provisions of significance are those that deal with capital expenditures, currently deductible costs and sale receipts. Several alternative tax approaches were available prior to passage of the 1986 Tax Reform Act. The new act's provisions, however, have completely changed the federal income tax treatment of timber income and expenditures, including those associated with short-rotation plantations. This paper analyzes the changes and discusses their economic implications for fuel wood culture.

18179 (CONF-9103215–, pp. 104-108) **Comparative economic analysis: Anaerobic digester case study.** Lusk, P.D. (North Carolina Dept. of Economic and Community Development, Raleigh (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

An economic guide is developed to assess the value of anaerobic digesters used on dairy farms. Two varieties of anaerobic digesters, a conventional mixed-tank mesophilic and an innovative earthen psychrophilic, are comparatively evaluated using a cost-effectiveness index. The two case study examples are also evaluated using three other investment merit statistics: simple payback period, net present value, and internal rate of return. Life-cycle savings are estimated for both varieties, with sensitivities considered for investment risk. The conclusion is that an earthen psychrophilic digester can have a significant economic advantage over a mixed-tank mesophilic digester because of lower capital cost and reduced operation and maintenance expenses. Because of this economic advantage, additional projects are being conducted in North Carolina to increase the rate of biogas utilization. The initial step includes using biogas for milk cooling at the dairy farm where the existing psychrophilic digester is located. Further, a new project is being initiated for electricity production with thermal reclaim at a swine operation.

18180 (CONF-9103215–, pp. 109-116) **Char-recirculation biomass gasification system–a site-specific feasibility study.** Purdy, K.R. (Tennessee Technological Univ., Cookeville (United States)); Kerr, C.P.; Hensley, B.D. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A site-specific feasibility study was conducted for a char-recirculation biomass gasification plant which would dispose of the chippable solid residues of the area sawmills. The plant would receive green hardwood chips and convert them into active charcoal while producing process steam and electrical power. An economic analysis was performed on the basis of not-for-profit operation, marketing crushed active charcoal to a broker at a discounted price, and displacing purchased electric power. Given a market for the active charcoal, the plant was judged to be economically viable.

18181 (CONF-9103215–, pp. 123-128) **Ethanol from mixed waste paper.** Kerstetter, J.D. (Washington State Energy Office, Olympia (United States)); Lyons, J.K. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The technology, markets, and economics for converting mixed waste paper to ethanol in Washington were assessed. The status of enzymatic and acid hydrolysis projects were reviewed. The market for ethanol blended fuels in Washington shows room for expansion. The economics for a hypothetical plant using enzymatic hydrolysis were shown to be profitable.

18182 (CONF-9103215–, pp. 178-182) **In-home performance of pellet stoves in Medford and Klamath Falls, Oregon.** Barnett, S.G. (OMNI Environmental Services, Inc., Beaverton, OR (United States)); Houck, J.E.; Roholt, R.B. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Pollutant emissions, thermal efficiencies, and heat outputs of pellet stoves operating in homes located in Klamath Falls and Medford, Oregon were documented. Six stoves representing two commercially available, certified models were studied during the 1989-1990 heating season. Three models exempt from certification (a total of six stoves) were studied during the 1990-1991 heating season. An automated emission sampler (AES) system was used to conduct long-term, in-home monitoring of the stoves. The results of the studies have permitted an evaluation of the environmental and energy performance characteristics of the stoves. For the certified stoves, the average overall particulate emissions were 1.05 grams per hour (g/hr), which is about 75% lower than the best-performing cordwood stoves. The in-home particulate emission values were close to their laboratory certification values. Preliminary results for the exempt stoves produced an average particulate emission value of 2.02 g/hr. Also, for the certified stoves, altitude appeared to have little or no effect on particulate emissions and there appeared to be no differences in particulate emission rates between the two models studied. Polycyclic aromatic hydrocarbon (PAH) and carbon monoxide emissions were low. The carbon monoxide emission rates averaged 14 g/hr, the average net thermal efficiency of the stoves was 68%, and the average heat output was 8,747 Btu per hour. Similar data are currently being evaluated for the exempt stoves. Emission and energy performance data obtained for the pellet stoves assessed in this study demonstrated that pellet stoves offer a viable residential biomass-fueled heating option.

18183 (CONF-9103215–, pp. 183-185) **A systematic approach to locating opportunities for conversion from fossil fuel to wood residue.** Darwin, B. (WIND Associates, Colbert, GA (United States)); Gouffray, J.P. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A system was developed to determine which industries within the state of South Carolina are possible candidates for conversion from fossil fuel to wood residues. The system has identified over 100 industries that warrant further analysis. This approach is applicable to other states.

18184 (CONF-9103215–, pp. 138-142) **National survey of pelletized fuel manufacturers.** Whitney, G.L. (Washington State Energy Office, Olympia (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A national survey was conducted to better understand the pelletized fuel industry. Information from the survey was combined with previously published information and extrapolated to the industry as a whole to draw an industry profile. The industry profile separates producers by feedstock type, and provides information on reported production and capacity and total estimated production and capacity.

18185 (CONF-9103215–, pp. 202) **Employment opportunities, 1990's and beyond.** Davis, P.H. (Search North America, Inc., Portland, OR (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

At present there are hundreds of companies in the United States and abroad that are developing and producing alternative energy sources. The author represents a recruiting firm that provides support to companies in the power generation, waste stream, and wood products industries. He foresees an increased need for qualified professionals to staff these companies as the country deals with problems of energy demand, waste management, and the need to reduce our dependence on foreign oil supplies.

18186 (CONF-9103215–, pp. 203) **Economic impact of industrial wood energy use in the Southeast region of the United States.** Stephenson, C.D. (Tennessee Valley Authority, Muscle Shoals, AL (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

More than 1,000 commercial and industrial installations in the Southeast burn wood fuels. Collectively, these facilities consume 44.3 million green tons of fuelwood and 41.7 million tons per year of 'black liquor' residues. Considering the entire direct and indirect impacts of industrial wood energy expenditures as they ripple through the economy, activities associated with the use of industrial wood energy resulted in the production of over 71,000 jobs and $1 billion in personal income for the Southeast region in 1987. In addition, a total of $237 million in State and Federal tax revenues were generated through wood energy related economic activities. Growth projections indicate that by the year 2000, industrial wood energy utilization will generate approximately 97,000 jobs and $1.4 billion in income in the Southeast region.

18187 (CONF-9103215–, pp. 203-204) **Wood fired steam generation system for the University of Idaho district heating system.** Sawyer, T.R. (Univ. of Idaho, Moscow (United States)); Kirkland, L.A. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This paper is a general overview of the project to convert the University of Idaho's Power Plant from natural gas to wood waste as a primary fuel source. It includes the history and background of the project; the economic analysis used to select the combustion system; a general description of the plant and a more detailed description of the fuel and the combustor/gasifier; and discussion of some of the problems encountered.

18188 (INIS-mf–13169) **Hydropower and biomass - a successful combination.** Reichl, A. Verband der Elektrizitaetswerke Oesterreichs, Vienna (Austria). 17 Oct 1991 4p. (In German). (CONF-9110366–: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92627114. Source: OSTI; NTIS (US Sales Only); INIS.

The paper contains numbers on the importance of biomass and hydropower in the energy balance of Austria. The importance of the CO_2 taxes in the European Communities on the economics of different fuels is outlined. (Quittner).

18189 (INIS-mf–13170) **The Kaerntner Biotechnik promotes biomass heating at countryside in Carinthia.** Dominikus, K. (Kammer fuer Land- und Forstwirtschaft in Kaernten, Klagenfurt (Austria)). Landeskammer fuer Land- und Forstwirtschaft in Kaernten, Klagenfurt (Austria). 17 Oct 1991 3p. (In German). (CONF-9110366–: Austrian biomass day of the Oekoenergie, St.

Andrae (Austria), 17 Oct 1991). Order Number DE92627115. Source: OSTI; NTIS (US Sales Only); INIS.

The potential, some pilot projects and the perspective for use of biomass in Carinthia are outlined. (Quittner).

18190 (INIS-mf--13171) **Away from oil and towards biomass.** Schmidt, G. (Biowaerme GmbH, Graz (Austria)). Biowaerme GmbH, Graz (Austria). 17 Oct 1991 4p. (In German). (CONF-9110366--: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92627116. Source: OSTI; NTIS (US Sales Only); INIS.

The potential of biomass in Austria is outlined. (Quittner).

18191 (INIS-mf--13172) **District heating from wood - a chance for the future.** Woergetter, M. (Bundesanstalt fuer Landtechnik, Wieselburg (Austria)). Bundesanstalt fuer Landtechnik, Wieselburg (Austria). 17 Oct 1991 2p. (In German). Order Number DE92627117. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. AUSTRIA/biomass; AUSTRIA; BIOMASS; DISTRICT HEATING

18192 (INIS-mf--13173) **Combined hydraulic and biomass power - an answer to economic and ecological adaptation pressure on the energy supply system.** Pistauer, M. (Tauernkraftwerke AG, Salzburg (Austria)). Tauernkraftwerke AG, Salzburg (Austria). 17 Oct 1991 4p. (In German). (CONF-9110366--: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92627118. Source: OSTI; NTIS (US Sales Only); INIS.

On the large scale, there will be an economic pressure in the European Communities on coal and oil from the CO_2 taxes. The economic and ecological advantages of a combination of hydraulic and biomass power in Austria are emphasized. In particular a biomass remote heating pilot project is announced. (Quittner).

18193 (INIS-mf--13174) **Biomass has precedence at the Lower Austria Energy Supply Limited.** Schenk, K. Energie-Versorgung Niederoesterreich AG (EVN), Maria Enzersdorf (Austria). 17 Oct 1991 2p. (In German). Order Number DE92627119. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HOUSES/heating; AUSTRIA; BIOMASS; ECONOMICS; HOUSES; HEATING

18194 (INIS-mf--13175) **Sustainability as an economic principle.** Kopetz, H. Landeskammer fuer Land- und Forstwirtschaft in Steiermark, Graz (Austria). 17 Oct 1991 2p. (In German). (CONF-9110366--: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92627120. Source: OSTI; NTIS (US Sales Only); INIS.

short communication.

18195 (INIS-mf--13176) **Biomass as a new player on the energy field.** Grill, F. Salzburger Biotechnik reg. Gen.mbH, Salzburg (Austria). 17 Oct 1991 3p. (In German). (CONF-9110366--: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92627121. Source: OSTI; NTIS (US Sales Only); INIS.

short communication.

18196 (NEI-DK--831) **Environmental and economical aspects of selected energy system.** Energistyrelsen, Copenhagen (Denmark); Videncenter for Halm- og Flisfyring (Denmark); Dansk Teknologisk Inst., Taastrup (Denmark). Proevestationen for Solenergi. Nov 1991 70p. (In Danish). Order Number DE92506465. Source: OSTI; NTIS (US Sales Only); INIS.

An analysis of environmental and economical aspects of selected renewable energy systems is presented. The aim was to provide a basis for estimating the competitive status in each case, to review the consequences of technological development, to identify attractive markets and to evaluate the effects of various economic conditions. Calculation methods are described and individual solar heating systems are compared to oil-fired boilers, boilers fired with solid fuels are compared to oil-fired boilers and straw-fired cogeneration plants are compared with coal, fuel-oil and straw-fired district heating plants. Results are presented in the form of tables and graphs. (AB).

18197 (WAOENG--91-05) **Mixed waste paper to ethanol fuel: A technology, market, and economic assessment for Washington.** Washington State Energy Office, Olympia, WA (United States). Jan 1991. 85p. Sponsored by USDOE, Washington, DC (United States); Washington State Energy Office, Olympia, WA (United States). DOE Contract FG01-89CE26597. Order Number DE92011828. Source: OSTI; NTIS; GPO Dep.

The objectives of this study were to evaluate the use of mixed waste paper for the production of ethanol fuels and to review the available conversion technologies, and assess developmental status, current and future cost of production and economics, and the market potential. This report is based on the results of literature reviews, telephone conversations, and interviews. Mixed waste paper samples from residential and commercial recycling programs and pulp mill sludge provided by Weyerhauser were analyzed to determine the potential ethanol yields. The markets for ethanol fuel and the economics of converting paper into ethanol were investigated.

0940 Transport, Handling, and Storage

Refer also to citation(s) 18135, 18169, 18177

18198 (NEI-DK--841) **Project 2000: A new generation of district heating systems for smaller towns and international reference systems for Danish "turn-key" district heating plants. Final report.** Dansk Energi Management A/S, Viby (Denmark). Nov 1990 236p. (In Danish). Contract ENS-51191-91.0034. Order Number DE92506472. Source: OSTI; NTIS (US Sales Only).

The aims of the project were to establish a new district heating system in the towns of Ubby, Jerslev and Roerby (Denmark), to find methods of reducing the related costs, and to produce a system which could be used as a representative Danish example for interested parties from other countries. Where heating systems for houses in rural areas have previously used imported oil as fuel, it is now quite common that domestically produced straw is used. The technology presented here concerns innovative principles for laying down heat distribution pipes using a tunnel technique, new concepts for measuring energy, and a district heating network that is compatible with the internal systems of houses. The tunnel technique involves the "shooting" of a tunnel under the surface, so that digging is not necessary when laying pipes. The monitoring method introduced allows remote reading of the operation of the system and monitoring of results. Detailed suggestions are given for improving dimensioning of district heating compatibility with houses, resulting in better integration. It is concluded that the use of straw as fuel, of a heat accumulator tank and of central storage facilities for straw should help to lower costs considerably (AB) 17 refs.

18199 (NUTEK-A-B--92-1) **Storage study with waste fuels based on municipal solid wastes.** Aakesson, M. (Lund Univ. (Sweden). Waste Management and Recovery); Bramryd, T.; Hogland, W. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1991. 60p. (In Swedish). Project NUTEK-266-115. Order Number DE92506568. Source: OSTI; NTIS (US Sales Only).

A storage study with waste fuels based on Municipal Solid Waste (MSW) has been carried out. Four different types of waste fuels have been examined; pelletized RDF (BRINI), reject RDF from a separation/composting plant, the dry fraction of the source separation trials with 'Wet and Dry', and household waste from a row house area where a source separation program with kitchen garbage grinder is in progress. Three different types of storage have been tested, well ventilated wood boxes with approx. size of 20 m^3 which were covered with plastic coated paper, compartments in a tent with approx. size of 50 m^3 and finally 100 m^3 piles covered with wood chips. Continuous monitoring of the biological activities including temperatures and concentrations of the gas components O_2, CO_2 and CH_4 has been carried out. The material analyses consist of moisture and ash content, substance losses, material compositions, heating values and fungi spore concentration. An investigation concerning how the heating value on a dry and ash free basis of a waste fuel is changed during a microbiological degradation has been carried out. A water balance over the pile of pelletized RDF has been formulated. The results of our study show that the materials can be placed in order of rank from the most to the least biological active in the following way: RDF, pelletized RDF, household waste, and dry fraction. This shows that the substance losses is considerable in the two mechanically separated materials (RDFs), while losses in the other two source separated materials are not detectable. Heat generation in the two most biologically active waste fuels seems to be considerable that a pronounced drying effect takes place. This leads to the fact that the heating value on a as-received-basis is increasing. This phenomena does not occur in the other two biologically more stable waste fuels. Any concentrations that show a risk of allergic alveolitis has not been observed.

0950 Environmental Aspects

Refer also to citation(s) 17801, 18135, 18140, 18142, 18144, 18151, 18156, 18158, 18169, 18175, 18182, 18188, 18192, 18194, 18196, 18210, 19390, 19459

18200 (CONF-9103215–, pp. 48-57) **Toxic and hazardous air pollutants from co-firing biomass fuels, fossil fuels, MSW and RDF.** Junge, D.C. (Univ. of Alaska, Anchorage (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Toxic and hazardous pollutants are defined and then are considered from the perspective of pollutants which enter the combustion process with the fuel (principally the metals and metallic compounds) and pollutants which are formed as products of incomplete combustion. Control strategies are reviewed through the entire process including fuel preparation and storage, combustion control and the application of air pollution control devices. Measurement techniques for specific toxic and hazardous air pollutants are discussed.

18201 (CONF-9103215–, pp. 58-61) **Impact of the 1990 Clean Air Act amendments to the biomass industry.** James, A.J.; Bray, D.C. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The direct impacts of the Clean Air Act on the existing biomass industry will be focused in four areas: Title I (nonattainment), Title III (air toxics), Title V (operating permits) and Title VII (enforcement). These four Titles will result in tighter emission limitations and other requirements on existing sources of air pollution. Two other areas should provide incentives for new biomass utilization. Title II (mobile sources) will promote the development of a clean fuels program; biomass is expected to play a key role as ethanol fuel resources are explicitly promoted by the Act. Title IV (acid rain control) will encourage the generation of power through renewable energy sources, including biomass. While there are several new requirements which will require industry to tighten controls and reduce emissions, there are also significant benefits to the biomass industry as well. A Title by Title description explains the applicable new requirements and the potential economic opportunities.

18202 (CONF-9103215–, pp. 62) **Implications for bioenergy development.** Wilson, T.E. (Environmental Protection Agency, Seattle, WA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The Clean Water Act establishes several constraints that bioenergy developers should keep in mind. These center primarily around the need to ensure that any contaminated waters or waste products are disposed of in a manner that does not harm the groundwater. In fact, states throughout the country are currently developing groundwater protection programs. These efforts to protect groundwater may, in fact, have both direct and indirect benefits to bioenergy development. For example, both dairies and feed lots will be under increasing pressure to reduce contamination from animal waste. These controls will be costly. This, together with rising energy costs, may make cogeneration for such facilities economically attractive. Alternatives to burial may also have to be found for other organic material that has been shown to cause groundwater contamination, such as onion culls, chicken carcasses, etc. This could increase its economic viability.

18203 (CONF-9103215–, pp. 70-74) **Potential for renovation of municipal wastewater using biomass energy hardwood plantations.** Mengal, D. (CH2M Hill, Atlanta, GA (United States)); Frederick, D. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Application of municipal wastewater to plantations offers a viable opportunity to dispose of nutrients and pollutants, while protecting water quality. Production of woody biomass for energy or pulp mill furnish, at levels greater than that obtained in non-irrigated plantations, is feasible and markets exist in the eastern United States for this biomass. Plantations of sycamore (Platanus occidentalis L.), sweetgum (Liquidambar styraciflua L.), and loblolly pine (Pinus taeda L.) are being established on the coastal plain of eastern North Carolina at the city of Edenton for application of municipal wastewater. Research investigating the production of biomass, production costs, and wastewater renovation are presented. Dry weight biomass following the fourth year of growth for sycamore and sweetgum was 18.7 and 7.4 Mg/ha, respectively. Plantation establishment and system costs were $26,460.12/ha. Comparison costs with a smaller but similar system at Woodland, NC, are presented. Nutrient assimilation and wastewater renovation data are being collected and are not yet available for publication.

18204 (CONF-9103215–, pp. 75-77) **Urban wood: Fuel from landscapers and land fills.** Miles, T.R. (Thomas R. Miles Consulting, Portland, OR (United States)); Miles, T.R. Jr. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Wood recovered from urban landscaping, construction and building demolition has become an important fuel for several new power plants. Sources, composition, and requirements for fuel preparation, handling, firing and emissions control are described from experience at several plants. Urban wood waste fuels are suitable for steam and power generation if precautions are taken to process the fuel and provide uniform flow to the boiler.

18205 (CONF-9103215–, pp. 43-47) **Landfill gas management and end use.** Vonasek, D.G. (Sweet-Edwards/EMCON, Inc., Bothell, WA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United

States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Landfill gas, like sewer and marsh gas, is a biogas. It is generated by the biological decomposition of organic matter in solid waste landfills. Once gas production begins, it can continue for 30 to 50 years or more, until all of the organic matter is completely decomposed. The evolution of landfill gas management in the United States began in the 1970s because of the concerns for health and safety. Over the years, there have been many documented cases of loss of human life or serious injury caused by explosions or accumulations of landfill-derived gases. The federal Environmental Protection Agency's (EPA's) Resource Conservation and Recovery Act of 1976 (RCRA) established the first federal regulatory performance criteria requiring landfill owners and operators to control the escape of landfill gas. These regulations have led to the installation of hundreds of gas control systems at landfill sites across the country. Landfill gas recovery, however, has also been demonstrated to be a profitable venture. The success that the landfill gas recovery industry experienced in the 1970s, 1980s, and, hopefully, in the 1990s, has proven that it is possible to use our landfills in a beneficial manner, while reducing our country's dependence on foreign oil.

18206 (CONF-9103215–, pp. 197) **Methods and instrumentation for the measurement of emissions from biomass combustion.** Houck, J.E. (OMNI Environmental Services, Inc., Beaverton, OR (United States)); Fisher, M.S.; Barnett, S.G.; Roholt, R.B. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Particulate and gaseous emissions from biomass combustion represent a major source of atmospheric pollutants world-wide. Carbon monoxide, PM_{10} particles and toxic and carcinogenic products of incomplete combustion from biomass present serious environmental health problems. Sampling and monitoring instrumentation has been developed to quantify biomass emissions for a variety of pollutants. Sampling and monitoring have been conducted for industrial point sources, residential wood and other biomass-burning, in-home appliances, area-wide agricultural burning, and forestry-related burning. Example results and protocols are presented.

18207 (CONF-9103215–, pp. 199-200) **Emissions control improvements in biomass combustion systems.** Isaacs, G.P. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Recent clean air legislation has provided a necessity for serious flue gas cleanup. Because baghouses commonly burn down or explode, they are undesirable for biomass flue gas cleanup. In the best available control technology (BACT) analysis a wet scrubbing system is usually chosen for wood waste combustion. There are many options available to accomplish wet particulate scrubbing and it helps to understand these options in order to select the best and most economical system for various biomass applications.

18208 (INIS-mf–13177) **Cogeneration power plants based on biomass - a building block for a closed-cycle economy.** Steinmueller, H. Oesterreichische Vereinigung fuer Agrarwissenschaftliche Forschung, Wien (Austria). 17 Oct 1991 3p. (In German). (CONF-9110366–: Austrian biomass day of the Oekoenergie, St. Andrae (Austria), 17 Oct 1991). Order Number DE92626263. Source: OSTI; NTIS (US Sales Only); INIS.

Results of a governmental feasibility study on decentralized, biomass-based dual-purpose power plants in the 100 kW range are given, including electricity-production prices. (Quittner).

18209 (VTT-TIED–1174) **Methane emissions from agriculture, waste waters and dumping sites in Finland.** Salmikangas, T. (Technical Research Centre of Finland, Espoo (Finland). Chemical Lab.); Laukkarinen, A. Technical Research Centre of Finland, Espoo (Finland). Oct 1990. 19p. (In Finnish). Order Number DE92506498. Source: OSTI; NTIS (US Sales Only); INIS.

The methane emissions released from agriculture, waste water processing and dumping sites are reviewed in this report, which is one of the national reports estimating the emissions of greenhouse gases. The most up to date information of emission sources are used as the basis for estimation of emissions. The information used cowers mainly the years 1987 and 1988. The methane emissions from live stock production in Finland was about 165 000 t/a in 1989, those from agriculture about 15 000 t/a, and those from dumping sites about 30 000 t/a. The methane emissions from municipal and industrial waste water processing have been estimated to be 37 000 t/a.

0970 Legislation and Regulations

Refer also to citation(s) 18809

0980 Waste Management

Refer also to citation(s) 17801

18210 (CONF-9103215–, pp. 196) **Wood ash as a soil additive and liming agent.** Campbell, A. (Univ. of Idaho, Moscow (United States)); Etiegni, L.; Mahler, R.L. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

This study evaluated wood ash as an agricultural soil supplement and liming material. Winter wheat (Triticum aestivum) and poplar (Populus sp.) were grown in a greenhouse on six different Idaho soils amended with different ash concentrations. At ash levels equal to or lower than 2%, no detrimental effects were observed. In fact, the biomass of the wheat and the caliper and height of the poplar cuttings increased more at 2% ash 940 metric tons/ha than with the control soil. These results suggest that wood ash could be used in agricultural applications as a low analysis fertilizer containing potassium and as a liming agent. Land application of wood ash could be less expensive and more environmentally sound than present landfilling practices.

18211 (CONF-9103215–, pp. 196) **Physical and chemical properties of hog fuel and fines from a classified logyard waste.** Folk, R.L. (Univ. of Idaho, Moscow (United States)); Campbell, A.G. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Disposing of large volumes of logyard waste is a major problem for primary wood processors. Most logyard waste is still burned in combustors, landfilled, or stockpiled, but each of these disposal methods causes environmental problems. The study evaluates the physical and chemical properties of fresh and stockpiled logyard waste separated into three fractions by an industrial residue reclaim system that uses a rotary trommel screen and pneumatic classifier. The three fractions are rock, hog fuel and fines less than 5/16 inch. Fresh and stockpiled material produced hog fuel that averaged 50% moisture content, 7% ash content and 22 pounds per cubic food (oven dry basis), and is burned as a boiler fuel to produce steam for lumber drying. The fines are essentially neutral, pH = 7.2, and should have no detrimental environmental impact. The carbon to nitrogen ratio of the fines is greater than 190:1 and therefore has no nutritional value as a soil amendment. In summary, the reclaim system reduced logyard waste volume by separating the material into usable fractions.

18212 (VTT-TIED–1266) **Waste waters from biomass-based synthesis gas production.** Fagernaes, L. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Fuel and Process Technology). Technical Research Centre of Finland, Espoo (Finland). Aug 1991. 77p. Order Number DE92506494. Source: OSTI; NTIS (US Sales Only).

Processes developed for biomass synthesis gas production during the 1980s are U-GAS, PEATGAS, High-Temperature-Winkler, MINO, Omnifuel and Creusot-Loire. Waste waters from the processes with wood, peat and wastes as raw materials have been studied in laboratory and pilot units and at demonstration plants. In synthesis gas production, waste waters are formed in biomass drying, and in gas scrubbing and conversion. Major waste water impurities are solids, ammonia, cyanide, phenolics, benzene and polyaromatic compounds. Their concentrations are highly dependent on the gasification process used and on process conditions, such as pressure and temperature, gas treatment, amount of scrubbing water, and waste water recirculation. The waste waters from biomass gasification processes resemble those from coal gasification and coking and contain mainly the same impurity components, but in different rations. The process waste waters require treatment before leading into water-courses or to a municipal purification plant, or before recirculation. The treatment is completely dependent on the concentration, amount and use of the waste water. Requirements set by the authorities and the maximum levels allowable in waste waters also vary in different reasons and ountries. Methods suited for the treatment of waste waters could be, on the basis of purification methods applied for coal-based waste waters, solids removal e.g. by centrifugation or filtration, ammonia removal by steam stripping and phenol removal by extraction, and, after pretreatment, treatment at a biological purification plant. When needed, activated carbon filtration, ion exchange or ozonation can be applied after the biological treatment. However, research activities are required to test and find methods suitable for the waste waters from biomass-based synthesis gas production.

0990 Products and By-Products

18213 (NEI-DK–785, pp. 7-24) **Extraction of the hemicellulose from straw and fermentation of xylose.** Joensen, E. (Bioteknisk Institut, Kolding (DK)); Reffstrup, T. Bioteknisk Inst., Kolding (Denmark). 1990. 38p. In *Information activities at the department of biotechnology 1990*. Order Number DE92506304. Source: OSTI; NTIS (US Sales Only).

Xylose comprising 25% of all lignocellulose produced from annual plants and hardwood is a very poorly utilized resource. In order to enhance utilization of xylose from annuals, methods for the liberation of xylose have been studied and compared to procedures developed for hardwoods. Annuals appear more difficult to hydrolyse by autohydrolysis (steaming). This is ascribed to their markedly higher internal buffer capacity when compared to beech wood. Acid hydrolysis by sulphurous acid liberates approx. 1/2 of the xylan content in barley or rapeseed straw. The same degree of liberation of xylan is found by autohydrolysis of birch and beech wood. The hydrolysates after posthydrolysis can be utilized for fermentative conversion of xylose to ethanol. Alkaline hydrolysis was found unfit for the preparation of fermentable hydrolysates due to extensive degradation of the sugars and to the high salt content resulting from the use of easily soluble bases. Alkaline hydrolysis by $Ca(OH)_2$ gives only partial liberation of xylan. The yeast Candida shehatae CBS 5813 was chosen among other yeasts investigated for stirred fermentations of xylose to ethanol. In the fermentations a limited supply of oxygen enhanced the ethanol yield and the conversion rate. The ethanol yield was 0.43 g ethanol per gram xylose converted. The specific ethanol produciltion rate was 0.14 g ethanol/g yeast per h. (author) 15 refs.

18214 (NEI-DK–815) **Drying of fibers from degassed liquid manures where the Rutgers method of composting is used.** Carlsbaek, M. VJ Komposteringssystemer A/S, Holstebro (Denmark). 1991 58p. (In Danish). Contract ENS-UVE-90.0197. Order Number DE92506386. Source: OSTI; NTIS (US Sales Only).

The aim was to promote the sale and thus further use of fibers resulting from the degassing of liquid manures by innovating a drying process which enables it to be easily stored for longer periods. A further aim was to discover, by surveying relevant literature, the possible uses of these fibers and to test the Rutgers method of composting (for drying them) which involves the use of controlled ventilation and temperature sensors placed in the pile. The control unit is set at 60 degrees centigrade in the hottest part of the pile. Ventilation takes place through solid tubes which are connected with the ventilator at one end and corked at the other end. Small holes are bored throughout the length of the tubes. The fibers are piled up over the tubes. The main pile itself should not be over 2 meters high. Ventilation is used not only for cooling and thus temperature control, but also to make sure that there is enough oxygen. The testing of this method is described in addition to the economical aspects of large-scale composting. Generally, it is concluded that the Rutgers method is satisfactory as a method for composting but the compost should be mixed with peat, especially if stored in plastic bags. (AB).

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 18656

18215 **Process for the oxidative coupling of methane to higher hydrocarbons.** Smith, K.J.; Galuszka, J.Z. 14 Nov 1991. Filed date 14 May 1990. Canada Patent patent application 2016675. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

The oxidative condensation reaction of methane allows production of ethane, ethylene, and usually small amounts of higher hydrocarbons from methane. Higher C2+ yields are obtainable by increasing the methane conversion or the C2+ selectivity, or both. Unfortunately, higher selectivity is usually observed at lower conversion for this process. If selectivity is high, a high C2+ yield may be achieved by recycling the reactants. It has been discovered that the higher C2+ selectivity may be achieved by introduction of an auxiliary oxygen stream into the reactor used in the process. In accordance with the invention, this oxygen stream is introduced into a particular catalyst zone of the reactor. More specifically, increased yields of C2+ products may be obtained by introducing the auxiliary oxygen stream at the lower end of the catalyst zone and/or underneath that zone. The primary methane/oxygen stream is fed into the entrance of the reactor and reacted at a temperature of 600-1,000°C and a pressure of 101-800 kilopascals. Experiments are described to illustrate the process of the invention. 1 fig., 4 tabs.

1004 Combustion

18216 (UCRL-JC–106910-Rev.1) **High-temperature ignition of propane with MTBE as an additive: Shock-tube experiments and modeling: Revision 1.** Gray, J.A. (Sandia National Labs., Livermore, CA (United States)); Westbrook, C.K. Lawrence Livermore National Lab., CA (United States). Dec 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707–22-Rev.1: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92008933. Source: OSTI; NTIS; GPO Dep.

Ignition of propane has been studied in a shock tube and by computational modeling to determine the effect of methyl tert-butyl ether (MTBE) as a fuel additive. MTBE and isobutene were added to amounts up to 25% of the fuel to propane-oxygen-argon mixtures to shock-tube experiments covering a range of temperatures between 1450 and 1800 K. Ignition delays were measured from chemiluminescence at 432 nm due to excited CH radicals. The temperature dependence of the ignition rates was analyzed to yield Arrhenium parameters of $E_a \sim 40$ kcal/mol and log(A) ~ 9.0 sec^{-1} for the overall reaction. Reactions involving MTBE and its decomposition products were combined with an established propane mechanism in a numerical model to describe the kinetic interaction of this additive with a typical hydrocarbon fuel. The experiments and the kinetic model both show that MTBE and isobutene retard propane ignition with nearly equal efficiency. The kinetic model demonstrates that isobutene kinetics are responsible for inhibition by both MTBE and isobutene, and the specific elementary reactions which produce this behavior are identified. 19 refs., 1 fig., 3 tabs.

1005 Transport, Handling, and Storage

Refer also to citation(s) 17865, 17866

1007 Economic, Industrial, and Business Aspects

Refer also to citation(s) 18809

1009 Environmental Aspects

Refer also to citation(s) 17802

1010 Legislation and Regulations

Refer also to citation(s) 18809

13 HYDRO ENERGY

Refer also to citation(s) 18633

1301 Resources and Availability

18217 (DOE/ID–10338) **Uniform criteria for US hydropower resource assessment: Hydropower Evaluation Software (HES) user's manual.** Francfort, J.E. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Matthews, S.D.; Rinehart, B.N. EG and G Idaho, Inc., Idaho Falls, ID (United States); USDOE Idaho Field Office, Idaho Falls, ID (United States). Oct 1991. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012225. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's (DOE) National Energy Strategy (NES) and the DOE Interagency Hydropower Resource Assessment team requires a representative estimate of the hydropower development potential in this country. The Hydropower Evaluation Software (HES) is a computer model that was developed by the Idaho national Engineering Laboratory (INEL) for this purpose. HES measures the potential hydropower resources available in the United States, using a national uniform criteria for measurement. HES was developed and tested employing hydropower information and data provided by the Southwestern Power Administration (SWPA). HES is a dBASE 3 PLUS dBASE 4 menu driven software application. HES provides the personal computer user with the ability to assign environmental attributes to potential hydropower projects and to calculate a development suitability factor for each project based on the environmental attributes. HES also provides a report capability based on the suitability factors. This document details HES's functions, capabilities and the assumptions exercised.

1302 Site Geology and Meteorology

18218 (NEI-NO–205) **Modeling snowmelt runoff processes in temperate and arctic environments.** Sand, K. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Oct 1990 181p. Order Number DE92506542. Source: OSTI; NTIS (US Sales Only).

Snowmelt runoff processes are of major importance in the hydrology of northern climates. In runoff modeling and forecasting it is therefore important to understand the metamorphic processes taking place in a snowcover and the mechanisms controling the snowmelt. Processes such as energy transfers in a snowcover, metaemorphism of snow, snowmelt generation and meltwater percolation are reviewed from existing literature. Different techniques of modeling snowmelt and meltwater percolation are also investigated. A total number of 16 different conceptual models for calculation of hourly snowmelt runoff are tested against lysimeter observations of snowmelt runoff at Svarttjoennbekken (63°19'N, 10°39'E) for the snowmelt period in 1988. The models vary in complexity. The simplest model estimating snowmelt runoff as a linear function of air temperature only, the most complex model uses air temperature and net short wave radiation as indexes for melt rate: In addition, the meltwater is routed through a two-linear-reservoir model to provide lag and attenuation of the meltwater wave percolating through the snowpack. As a reference for the performance of the conceptual models, an energy balance model is established. The energy balance model is considered to be the most reliable way of estimating snowmelt provided that necessary data are available. 102 refs., 98 figs., 24 tabs.

1303 Plant Design and Operation

Refer also to citation(s) 18221

18219 (HAN–48422) **Proposed construction of Priest Rapids Dam in relation to Hanford Works.** Smothers, S.A. Hanford Works, Richland, WA (United States). 7 Jan 1953. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011314. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This paper summarizes the proposed construction of the Priest Rapids Dam on the Columbia River by the Atomic Energy Commission. Power generation to the Hanford Works and flood control for the surrounding area is the main goal for the construction of the dam. The summary covers the feasibility of the dam from its design, operation, benefits, security, drawbacks, etc.

1304 Legislation and Regulations

Refer also to citation(s) 18228

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 18219, 18225, 18284, 18585

18220 (DOE/EA–0457) **Salt Lake City Area Integrated Projects: Rate adjustment: Environmental assessment.** USDOE Western Area Power Administration, Salt Lake City, UT (United States). Salt Lake City Area Office. Aug 1990. 124p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012185. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has determined that the proposed firm power rate increase for the Salt Lake City Area Integrated Projects (Integrated Projects) power would not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969 (NEPA, 42 USC 4321, et seq.) and, as such, does not require the preparation of an environmental impact statement (EIS). This determination is based on an environmental assessment (EA) prepared by the Western Area Power Administration (Western) dated August 1990 (DOE/EA-0457). The EA identifies and evaluates the potential environmental and socioeconomic effects of the proposed action, and based on the analysis contained therein, DOE concludes that the impacts to the human environment resulting from the implementation of the rate increase would be insignificant.

18221 (DOE/ID–10376) **DOE Hydropower Program Engineering Research and Development 1977– 1991 summary report.** Chappell, J.R. EG and G Idaho, Inc., Idaho Falls, ID

(United States). May 1992. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013597. Source: OSTI; NTIS; GPO Dep.

The Engineering Research and Development Program was a part of the DOE Small-Scale Hydropower Program. The Small-Scale Hydropower Program was established in 1977 (a) to provide appropriate assistance to private and public sectors, and (b) to accelerate the development of hydroelectric power at existing dams amenable to the retrofitting or adding of hydroelectric equipment. The purpose of the Engineering Research and Development program was to promote, encourage, and support the development of hydropower. DOE provided funds to develop new technologies and adapt novel applications of existing related technologies to the hydropower field. The general goal of the program was to support the research of technology that would improve small hydropower. However, since much of the small hydropower potential was either marginally economical or uneconomical to develop, the primary emphasis was on the lowering of equipment costs or the costs of implementing the equipment. During the 15 year duration of the program about $5 million was spent on 34 projects with a wide variety of objectives. As with many research and development (R&D) programs the results of the small hydropower R&D program did not meet all of the initial goals. However, lessons were learned and some successes were achieved. This report summarizes the lessons learned as well as some of the successess and failures of the individual projects. The purpose of this report is to document not only the successful projects that were explored but also to delineate the deficiencies of the projects that were not found to be viable for the intended application to hydropower. Some of the concepts explored were found to be more suitable to other applications that the proposed use for hydropower at the time the project was investigated. As a result, the few concepts explored were found to be commercially viable and were continued in the private sector.

1306 Environmental Aspects

Refer also to citation(s) 18281, 18282, 18284, 18585

18222 (DOE/BP-1785) **Review of BPA funded sturgeon, resident fish and wildlife projects.** USDOE Bonneville Power Administration, Portland, OR (United States). Dec 1990. 31p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013335. Source: OSTI; NTIS; INIS; GPO Dep.

The Bonneville Power Administration (BPA) held a public meeting on November 19–21, 1991, for the purpose of review, coordination, and consultation of the BPA-funded projects for sturgeon, resident fish, and wildlife in the Columbia River Basin (Basin). The comments received after the meeting were favorable and the participants agreed that the meeting was stimulating and productive. The information exchanged should lead to better coordination with other projects throughout the Basin. This document list the projects by title, the project leaders and BPA's project officers, and an abstract of each leader's presentation.

18223 (DOE/BP/64840-3) **Cle Elum Lake restoration feasibility study: Fish husbandry research, 1989–1991: Annual report.** Flagg, T.A.; Mighell, J.L.; Ruehle, T.E.; Harrell, L.W.; Mahnken, C.V.W. USDOE Bonneville Power Administration, Portland, OR (United States); National Marine Fisheries Service, Seattle, WA (United States). Sep 1991. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-86BP64840. Order Number DE92011098. Source: OSTI; NTIS; GPO Dep.

The National Marine Fisheries Service (NMFS) and the Bonneville Power Administration (BPA) are involved in a project to evaluate the feasibility of re-establishing anadromous salmon runs to Cle Elum Lake in the Yakima River Basin of Washington state. Historically, the Yakima River system supported large runs of anadromous salmonids that contributed significantly to the Columbia River harvest. Habitat destruction and overfishing drastically reduced run abundance prior to the early 1900s. Salmon runs were eliminated from upper reaches of the Yakima River Basin with development of irrigation storage reservoirs without fishways in the early 1900s. The goal of the NMFS/BPA project is to determine if it is feasible for anadromous salmonids to recolonize the habitat above Cle Elum Dam under the present format of irrigation water withdrawal from the reservoir. The primary concern is whether anadromous fish can successfully exit Cle Elum Lake and survive downstream passage through the Yakima and Columbia Rivers to the ocean.

18224 (DOE/EIS–0131-Vol.2-Final) **Initial Northwest Power Act power sales contracts: Final environmental impact statement: Volume 2, Appendices A–L.** USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1992. 660p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012664. Source: OSTI; NTIS; GPO Dep.

This report consists of appendices A-L of the final environmental impact statement for the Bonneville Power Administration. The appendices provide information on the following: Ninth circuit Court opinion in Forelaws on Board v. Johnson; guide to Northwest Power act contracts; guide to hydro operations; glossary; affected environment supporting documentation; environmental impacts of generic resource types; information on models used; technical information on analysis; public involvement activities; bibliography; Pacific Northwest Electric Power Planning and Conservation Act; and biological assessment. (CBS)

18225 (DOE/EIS–0131-Vol.4-Final) **Initial Northwest Power Act power sales contracts: Final Environmental Impact Statement: Volume 4, Comments and responses.** USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1992. 177p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012666. Source: OSTI; NTIS; GPO Dep.

This volume of the Initial Northwest Power Act Power Sales Contracts Final Environmental Impact Statement (Final EIS) contains public comments addressing the Initial Northwest Power Act Power Sales Contracts Draft EIS, August 1990 and Bonneville Power Administration's (BPA) responses. The Introduction provides information about the process BPA follows in addressing these comments. Part I contains a listing of the Alternative Actions evaluated in the Final EIS; Part II is organized by Alternatives and includes summaries of the comments and BPA responses; Part III provides copies of the original comments letters, and, for ease of identification, are coded in the margins according to the alternative(s) addressed.

18226 (DOE/EIS–0156) **Cowlitz Falls final environmental impact statement.** USDOE Bonneville Power Administration, Portland, OR (United States). Dec 1990. 249p. Sponsored by USDOE, Washington, DC (United States). (DOE/BP–1523). Order Number DE91007408. Source: OSTI;NTIS; GPO Dep.

The Public Utility District No. 1 of Lewis County (the Applicant or the District) proposes to construct and operate a hydroelectric project with an installed capacity of 70 MW at Cowlitz Falls, on the Cowlitz River near the towns of Morton and Randle, Washington. This Final Environmental Impact Statement analyzes several alternatives to the proposed project, including alternative project designs, a woodwaste facility, a coal-fired plant, and no-action. The analysis of alternative designs of the proposed project includes reservoirs with operating levels at elevation 862 feet mean sea level (EL 862) and elevation 872 feet mean sea level (EL 872), and two alternative transmission line rights-of-way. Construction and operation of the proposed project at EL 862 is the preferred hydroelectric alternative. A reservoir with an operating level of EL 862 would have significantly fewer adverse impacts than a reservoir at EL 866 or 872. Based on the available information, the Applicant's proposed transmission line route appears to be the preferred alternative. Woodwaste generation could represent an environmentally preferable alternative, however, a woodwaste plant would have a shorter operating life than a hydroelectric facility, and it would cost more money both initially and over a 50-year operating period. 58 refs., 19 figs., 31 tabs.

18227 (IVO-B–10/91) **Recreation value of a waterway and changes in this value.** Aittoniemi, P. Imatran Voima Oy (IVO), Helsinki (Finland). 1991. 59p. (In Finnish). Order Number DE92506512. Source: OSTI; NTIS (US Sales Only); INIS.

The uniquely rich hydrological and archipelagic nature of Finland creates versatile opportunities for spending of leisure time. As various uses of waterways compete with each other, it is difficult to compare advantages and disadvantages of operations in view of various interests. This is why efforts have been made to develop methods to make the effect commensurable. Usability of shores is one important factor in the assessment of recreation use of waterways. When influence of water level changes in usability of shores is estimated, shore and bottom slope and quality, and uses and user numbers of the shores must be known. In several assessment methods, usability of shore is depicted by distance of the shifted shoreline (due to the changed water level) from the 'good' status. The studies on changes in the recreation value or usability of shores should be started by making efforts to classify and estimate various effects separately. If the value is wished to be given as one figure, the calculation basis applied, the weights and the used value functions must be stated clearly with the results. It is equally important to make a sensitivity analysis, i.e. to study effects of changes in uncertain input data on the results.

18228 (WSEO–92-016) **Washington State hydropower development/resource protection plan: Draft 2.** Washington State Energy Office, Olympia, WA (United States). Jan 1992. 116p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011819. Source: OSTI; NTIS.

The purpose of the second draft plan is to meet the requirements of a comprehensive plan under the Federal Power Act. The Electric Consumers' Protection Act of 1986 clarified the meaning of Section 10(a) of the Federal Power Act concerning comprehensive plans and their effect on the Federal Energy Regulatory Commission (FERC) licensing process. The Act made explicit the right of a state or state resource agency to prepare a comprehensive plan for a "waterway or waterways" and to have this plan be given the consideration by FERC. In 1989, the Washington State Legislature passed comprehensive hydropower planning legislation, "an act related to hydropower development/resource protection." The legislation directed the development of a state comprehensive hydropower plan to serve the broad public interest regarding development of cost-effective electricity and conservation of river-related environmental values. The second draft plan represents the work of the Washington State Energy Office; the Washington State Departments of Ecology, Fisheries, Wildlife, and Natural Resources; the Washington State Parks and Recreation Commission; and the Department of Community Development's Office of Archaeology and Historic Preservation. The history and concept of a state hydropower comprehensive plan. The purpose, scope and methodology for developing the plan are outlined. A Washington State River Resource/Hydropower Database is described. An evaluation of Environmental values and Hydropower Development to include resource protection areas is presented. Finally, state agency permitting and planning processes for hydropower development and resource protection are described.

1307 Power-Conversion Systems

Refer also to citation(s) 18221

18229 (ENET–8900200/1) **Erosion mechanisms occurring in hydro-electric power generation equipment.** Schmid, R.K. (Sulzer Innotec, Winterthur (CH)). Bundesamt fuer Energiewirtschaft, Bern (Switzerland). 15 Sep 1990. 109p. Order Number DE92515344. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

Hydro-electric power generation equipment can suffer substantial damage through erosive wear caused by solid particles in the water. In order to maintain power generation efficiency and prolong service life, erosion resistant materials are required. Thermal spray coatings based on WC/Co(Cr) and Cr_2O_3 show promise as a viable solution. In order to develop these coatings tests were conducted in the laboratory and in service. An important part of the investigation was the examination of the erosive process itself in order to derive an understanding of what a material is subjected to and how it fails. Erosion mechanism studies have shown that all surfaces exposed to low angle impingement erosion tend to attain a wavy surface profile. The geometry of these waves as a function of erosive conditions and material type is worthy of further study. If such a study is successful, current eroded materials would require a quick examination, revealing important information on the erosive environment present, thereby making the choice of the correct coating material far easier and certain than it is using existing methods. Overall, WC containing coatings, with carbides in the order of 3-5μm in diameter, performed the best. CoCr as a matrix was found to be superior to Co and Ni matrices. The performance of WC/CoCr coatings can be further enhanced through powder refinement. The carbide size distribution must be narrowed as at present it is far too wide thereby not achieving the ultimate erosion resistance possible for the material system. (author) 48 figs., 7 tabs., 10 refs.

18230 (NEI-NO–207) **Transient characteristics of high-head Francis turbines.** Nielsen, T.K. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Dec 1990 108p. Order Number DE92506544. Source: OSTI; NTIS (US Sales Only).

One of the main dimension criteria for hydro power plants is the dynamic behavior of the system during large load changes such as full load rejection or full load admittance. This causes huge pressure transients in front of the turbine and surges in the surge shafts. In models for dynamic analyses purposes, the turbine defines the flow in the system, partly by the guide vane opening, and for reaction turbines, partly by the change in rotational speed. High head Francis turbines, and in particular pump turbines, have a significant decrease in flow as the rotational speed increases. For governor stability, this is very convenient, as it gives a natural decrease in hydraulic power when the turbine gains speed. Therefore, this effect is often referred to as "self governing". Dealing with pressure transients, however, the self governing causes higher change in flow, and thereby higher retardation forces during a load rejection. Dynamics models of hydro turbines are normally based on the assumption that the performance diagram, often referred to as the Hill diagram, represents the turbine behavior stationary, as well as, in dynamic performance. The main purpose of this study has been to check on this assumption by means of an experimental investigation. The experiments show that the dynamic trace, by no means, follows the stationary measured flow characteristics. In order to analyse the results a dynamic simulation model of the laboratory system including the turbine, was developed. The turbine model is based on the one dimensional Euler turbine equation, which basically describes how the turbine behaves at different modes of operation. The author has proven that the reason for the different behavior of the turbine in stationary and dynamic performance is the hydraulic inertia between the defined inlet and outlet of the turbine. 21 refs., 41 figs., 6 tabs.

18231 **Propeller blade configuration.** Do, H. 10 Jan 1992. Filed date 9 Jul 1990. Canada Patent patent application 2020765. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A propeller turbine runner is disclosed which is suitable for applications in large hydro power generation installations operating under low head, high volume water conditions. The runner of the invention will rotate at a constant speed but will respond to environments where a constant speed is not a condition of operation. In the design of the propeller-type runner, the leading edge of each blade leans forward from the root in the direction of rotation to reduce cavitation and increase efficiency. The lean provided to each blade of a five-blade design is such that the leading edge of each blade obscures a large portion of the trailing edge of the preceding blade. 5 figs.

14 SOLAR ENERGY

Refer also to citation(s) 18633, 18685, 18728

1403 Economic, Industrial, and Business Aspects

18232 (DOE/EIA–0174(90)) **Solar collector manufacturing activity, 1990.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 26 Feb 1992. 64p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012428. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Solar Collector Manufacturing Activity 1990 report prepared by the Energy Information Administration (EIA) presents summary and detailed data provided by domestic manufacturers on shipments of solar thermal collectors and photovoltaic cells and modules. Summary data on solar thermal collector shipments are presented for the period 1974 through 1990. Summary data on photovoltaic cell and module shipments are presented for the period 1982 through 1990. Detailed information for solar thermal collectors and photovoltaic cells and modules are presented for 1990.

1405 Solar Energy Conversion

Refer also to citation(s) 19019

18233 (DOE/ER/13506-37) **Photochemical solar energy conversion utilizing semiconductors localized in membrane-mimetic systems: Performance report, April 1, 1989-August 31, 1991.** Fendler, J.H. Syracuse Univ., NY (United States). Dept. of Chemistry. 31 Aug 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13506. Order Number DE92011115. Source: OSTI; NTIS; INIS; GPO Dep.

Extending the frontiers of colloidal photochemistry and colloidal electrochemistry to solar photochemistry research had been the main objective of this research. More specific objectives of this proposal include the examination of semiconductor-particle-mediated photoelectron transfer and photoelectric effects in different membrane mimetic systems. Emphasis had been placed on developing bilayer lipid membranes and Langmuir-Blodgett films as new membrane-mimetic systems, as well as on the characterization and utilization of these systems.

18234 (ENET-8900459/1) **Plasma physical characteristics of Silan RF plasmas used for the separation of amorphous silicium.** Hollenstein, C. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Howling, A.; Dorier, J.L. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Jun 1991. 35p. (In German). Order Number DE92515361. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

This project report comprises the work completed on the CRPP as part of the BEW project EFREN(89)17 in the field of the separation of amorphous and microcrystalline silicium with the aid of the VHF method. The project is based on collaboration between IMT Neuchatel and the CRPP and is financed by the BEW. In addition to the construction of the experiment and the diagnostic methods for this the following main results were obtained. The low electrode voltages found for the excitation frequencies in the VHF range result in a low energy ion bombardment of the film - the powder formation in silan plasmas in the function of the substrate temperature, the input rating and the rating modulation were examined using a new diagnostic method (the measurement of the ABEL inverted emission profiles shows that plasmas with higher excitation frequencies are more homogeneous) for comparison purposes microcrystalline and amorphous silicium layers are separated at 13 MHz and in the VHF range in the same reactor - the important question of the effective plasma rating was examined in detail. The results form an important basis for understanding the separation as a function of the frequency. figs., tabs., refs.

18235 (ENET-9100290/1) **Optimising the surface of photovoltaic panels according to the static inverter.** Affolter, P. (Bureau d'Etudes Keller-Burnier, Lavigny (CH)); Keller, L. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Nov 1990. 38p. (In French). Order Number DE92515363. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The present study is intended to define which photovoltaic panel surface must be combined with a static inverter to construct the most economic plant. The inverter in fact represents a costly component of the plant which should from now on be used to the best effect, which is not the case in plants currently being built. The results of our simulations show that, depending on the conditions, optimum savings are made for an increase in panel field power from 20 to 40% compared with the inverter's rated power. Various parametric studies furthermore help define the effect of the type of inverter, site, slope and orientation, various losses, and price relative to the components. The theoretical model developed therefore provides an interesting answer to the question asked: all it needs is to be validated by measurements. figs., 5 refs.

18236 (ENET-9100290/2) **Seasonal optimisation of panel surfaces in a photovoltaic plant.** Affolter, P. (Bureau d'Etudes Keller-Burnier, Lavigny (CH)); Keller, L. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Feb 1991. 33p. (In French). Order Number DE92515364. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

By carefully calculating the panel surface in a photovoltaic plant connected to the network, energy can be obtained at a minimum cost price. This has been discussed in a survey entitled 'Optimisating the surface of photo= voltaic panels according to the static inverter'. This survey does not however describe how the price of energy varies during the year. This gap is filled by the present work which is helping show how to make optimum calculations in winter. Most of the simulations made during the course of the first study have been repeated. This has allowed new elements to be brought in. One example is the importance of the crystalline cell output-temperature characteristic. It is noted that the winter potential of a photovoltaic plant is greater than that of a solar power plant. This study has also facilitated better definition of the behaviour of the plant's production-surface characteristic. This shows the importance of having a static inverter capable, in the event of intense periods of sunshine, of limiting the energy injected at rated power. Many parametric studies are helping to show the important parameters of this type of plant for the period from October to March. figs., 3 refs.

18237 (NEDO-P-9089) **Basic survey on international cooperation concerning development of photovoltaic power generation technology overseas.** New Energy Development Organization, Tokyo (Japan). Mar 1991. 97p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE92514609. Source: OSTI; NTIS (US Sales Only).

This paper clarifies the situation of the photovoltaic power generation system used in developing countries in international cooperation by developed countries, which forms an important part in utilization of the photovoltaic power generation system. At the same time the paper makes a trial calculation of the future demand estimate of the system. Cooperation made by Japan is a survey on projects of village electrification in Pakistan, Thailand and Indonesia and a study of subjects on the future project promotion. As a project for which European countries, mostly EC cooperate for developing countries in Africa, a project of a water pump system is paid attention to. In this pump system the photovoltaic power generation is used as a power for drinking water and irrigation water. PV modules required, supposing that the electric power generation technology is applicable to the system, are about 1.6GW in the African area and the Asian/South Pacific area, and countries which are large in potential demand are India, China, Indonesia, Nigeria, Egypt and Ethiopia, etc. 22 figs., 22 tabs.

18238 (NREL/TP-210-4469) **US Photovoltaic Patents, 1988-1990.** National Renewable Energy Lab., Golden, CO (United States). Photovoltaics Div. Dec 1991. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE91015013. Source: OSTI; NTIS; GPO Dep.

This document contains US patents on terrestrial photovoltaic (PV) power applications, including systems, components, and materials, as well as manufacturing and support functions. The patent entries in this document were issued from 1988 through 1990. The entries were located by searching USPA, the data base of the US Patent Office. The final search retrieved all patents under the class "Batteries, Thermoelectric and Photoelectric" and the subclasses "Photoelectric," "Testing," and "Applications." The search also located patents that contained the words "photovoltaic(s)" or "solar cell(s)" and their derivatives. A manual search of the patents in the Solar Energy Research Institute (SERI) patent file augmented the data base search. After the initial list was compiled, most of the patents on the following subjects were excluded: space photovoltaic technology, use of the photovoltaic effect for detectors and subjects only peripherally concerned with photovoltaics. Some patents on these three subjects were included when it appeared that those inventions might be of use in terrestrial PV power technologies.

18239 (NREL/TP–411-4840) **Research on stable, high-efficiency amorphous silicon multijunction modules: Annual subcontract report, 1 January 1991–31 December 1991.** Banerjee, A.; Chen, E.; Clough, R.; Glatfelter, T.; Guha, S.; Hammond, G.; Hopson, M.; Jackett, N.; Lycette, M.; Noch, J.; Palmer, T.; Pawlikiewicz, A.; Rosenstein, I.; Ross, R.; Wolf, D.; Xu, X.; Yang, J.; Younan, K. National Renewable Energy Lab., Golden, CO (United States); United Solar Systems Corp., Troy, MI (United States). Apr 1992. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE92001244. Source: OSTI; NTIS; GPO Dep.

This report describes the progress made during Phase 1 of research and development program to obtain high-efficiency amorphous silicon alloy multijunction modules. Using a large-area deposition system, double-and triple-junction cells were made on stainless steel substrates of over 1 ft^2 area with Ag and ZnO predeposited back reflector. Modules of over 1 ft^2 were produced with between 9.2% and 9.9 initial aperture-area efficiencies as measured under a USSC Spire solar simulator. Efficiencies as measured under the NREL Spire solar simulator were found to be typically 15% to 18% lower. The causes for this discrepancy are now being investigated. The modules show about 15% degradation after 600 hours of one-sun illumination at 50°C. To optimize devices for higher stabilized efficiency, a new method was developed by which the performance of single-junction cells after long-term, one-sun exposure at 50°C can be predicted by exposing cells to short-term intense light at different temperatures. This method is being used to optimize the component cells of the multijunction structure to obtain the highest light-degraded efficiency.

18240 (NREL/TP–413-4835) **Development of a computer model for polycrystalline thin-film $CuInSe_2$ and CdTe solar cells: Annual subcontract report, 1 January 1990–31 December 1990.** Gray, J.L. (Purdue Univ., Lafayette, IN (United States)); Schwartz, R.J.; Lee, Y.J. National Renewable Energy Lab., Golden, CO (United States); Purdue Univ., Lafayette, IN (United States). Apr 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE92001242. Source: OSTI; NTIS; GPO Dep.

This report describes work to develop a highly accurate numerical model for $CuInSe_2$ and CdTe solar cells. ADEPT (A Device Emulation Program and Toolbox), a one-dimensional semiconductor device simulation code developed at Purdue University, was used as the basis of this model. An additional objective was to use ADEPT to analyze the performance of existing and proposed $CuInSe_2$ and CdTe solar cell structures. The work is being performed in two phases. The first phase involved collecting device performance parameters, cell structure information, and material parameters. This information was used to construct the basic models to simulate $CuInSe_2$ and CdTe solar cells. This report is a tabulation of information gathered during the first phase of this project on the performance of existing $CuInSe_2$ and CdTe solar cells, the material properties of $CuInSr_2$, CdTe, and CdS, and the optical absorption properties of $CuInSe_2$, CdTe, and CdS. The second phase will entail further development and the release of a version of ADEPT tailored to $CuInSe_2$ and CdTe solar cells that can be run on a personal computer. In addition, ADEPT will be used to analyze the performance of existing and proposed $CuInSe_2$ and CdTe solar cell structures. 110 refs.

18241 (NREL/TP–451-4751) **Research on defects and transport in amorphous silicon-based semiconductors: Annual subcontract report, 20 February 1991–19 February 1992.** Schiff, E.A. (Syracuse Univ., NY (United States)); Antoniadis, H.; Lee, J.K.; Wang, Q. National Renewable Energy Lab., Golden, CO (United States); Syracuse Univ., NY (United States). Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE92001223. Source: OSTI; NTIS; GPO Dep.

This report describes the results from research on two topics: (1) the effects of light-soaking on the electron drift mobility in a-Si:H, and (2) modulated electron spin resonance measurements and their relationship to the electronic correlation energy of the D center in a-Si:H. Both of these projects were undertaken to better determine where the "standard" model for a-Si:H breaks down. The standard model is reasonably successful in accounting for the most elementary "deep trapping" aspects of electron and hole transport in a-Si:H, and it accounts adequately for the sub-band-gap optical properties. However, it is much less clear whether it provides a sufficient basis for understanding several effects which are crucial in operating solar cells: electron and hole mobilities and recombination in the presence of light-bias and space-charge. In the standard model, one would not expect significant effects on drift mobilities due to light-soaking, which would be envisioned as simply increasing the D-center density. Similarly, in the standard model one would not anticipate a significant temperature dependence to electron spin resonance, because essentially all spins are already detected. Discussions in the available literature on the evidence regarding both effects were inconclusive. The work reported here sets considerably more stringent constraints on the magnitude of the two effects.

18242 (NREL/TP–451-4797) **Thin film cadmium telluride photovoltaic cells: Annual subcontract report, 23 July 1990–31 October 1991.** Compaan, A. (Toledo Univ., OH (United States)); Bohn, R. National Renewable Energy Lab., Golden, CO (United States); Toledo Univ., OH (United States). Apr 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE92001239. Source: OSTI; NTIS; GPO Dep.

This report describes research to develop to vacuum-based growth techniques for CdTe thin-film solar cells: (1) laser-driven physical vapor deposition (LDPVD) and (2) radio-frequency (rf) sputtering. The LDPVD process was successfully used to deposit thin films of CdS, CdTe, and $CdCl_2$, as well as related alloys and doped semiconductor materials. The laser-driven deposition process readily permits the use of several target materials in the same vacuum chamber and, thus, complete solar cell structures were fabricated on SnO_2-coated glass using LDPVD. The rf sputtering process for film growth became operational, and progress was made in implementing it. Time was also devoted to enhancing or implementing a variety of film characterization systems and device testing facilities. A new system for transient spectroscopy on the ablation plume provided important new information on the physical mechanisms of LDPVD. The measurements show that, e.g., Cd is predominantly in the neutral atomic state in the plume but with a fraction that is highly excited internally ($\geq$ 6 eV), and that the typical neutral Cd translational kinetic energies perpendicular to the target are 20 eV and greater. 19 refs.

1406 Photovoltaic Power Systems

Refer also to citation(s) 18236

1407 Solar Thermal Power Systems

18243 (SAND–91-1747) **Report on the test of the molten-salt pump and valve loops.** Smith, D.C. (Science Applications International Corp., Albuquerque, NM (United States)); Rush, E.E.; Matthews, C.W.; Chavez, J.M.; Bator, P.A. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011440. Source: OSTI; NTIS; GPO Dep.

The purpose of the molten-salt pump and valve loop test is to demonstrate the performance, reliability, and service life of full-scale hot- and cold-salt pumps and valves for use in commercial central receiver solar power plants. This test was in operation at Sandia National Laboratories National Solar Thermal Test Facility from January 1988 to September 1990. The test hardware consists of two pumped loops; the "hot-salt loop" to simulate the piping and components on the hot (565°C) side of the receiver and the "cold-salt loop" to simulate piping and components on the receiver's cold (285°C) side. Each loop contains a pump and five valves sized to be representative of a conceptual 60-MW_e commercial solar power plant design. The hot-salt loop accumulated over 6700 hours of operation and the cold-salt loop over 2500 hours during the test period. This project has demonstrated the performance and reliability required for commercial-scale molten-salt pumps and valves.

18244 (SAND–91-2203) **Testing of the single-element stretched-membrane dish.** Grossman, J.W.; Houser, R.M.; Erdman, W.W. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013680. Source: OSTI; NTIS; GPO Dep.

The goal of the Stretched-Membrane Dish Program is the development of a dish solar concentrator fabricated with a single optical element capable of collecting 60 kWt. Solar Kinetics, Inc., has constructed a prototype 7-meter dish to demonstrate the manufacturability and optical performance of this innovative design. The reflective surface of the dish consists of a plastically deformed metal membrane with a separate reflective polymer membrane on top, both held in place by a low-level vacuum. Sandia conducted a test program to determine the on-sum performance of the dish. The vacuum setting was varied 8.9- to 17. 2-cm of water column and the vertex to target distance was varied over a range of 15.24 cm to evaluate beam quality. The optimal setting for the vacuum was 11.4 centimeters of water column with the best beam quality of 6.4 centimeters behind the theoretical focal point of the dish. Flux arrays based on slope error from the CIRCE2 computer code were compared to the measured flux array of the dish. The uniformly distributed slope error of 2.3 milliradians was determined as the value that would produce a modeled array with the minimum mean square difference to the measured array. Cold water calorimetry measured a power of 23.3 ± .3 kWt. Reflectivity change from an initial value of 88.3% to 76.7% over a one year period. 12 refs.

18245 **Absorbing fluid receiver for solar dynamic power generation and solar dynamic power system.** Parker, R.Z.; Langhoff, P.W.; Bair, E.J. 3 Nov 1991. Filed date 3 May 1990. Canada Patent patent application 2016034. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A solar dynamic power generator has a heat cycle engine to generate power. The solar receiver of this generator has a working fluid including a radiant energy absorber selected from halogens and interhalogens. The receiver also has a hollow, cylindrical containment for containing the working fluid having a first end, a second end, and an inner wall. A hollow, cylindrical member is disposed within the containment. The cylindrical member has an inner wall and an outer wall, and defines a toroidal working fluid flow space within the containment and a receiving space within the inner wall of the cylindrical member. A window is disposed in the first end of the containment for admitting solar radiation in the receiving space and heating working fluid contained in the receiving space. The heated working fluid in the receiving space travels toward the first end of the containment. A latent heat storing material is disposed in the flow space between the outer wall of the cylindrical member and the inner wall of the containment for storing heat absorbed by the working fluid in the receiving space. Means are provided for coupling the working fluid with a heat engine, wherein at the end of the heat cycle, the working fluid is reintroduced into the receiving space toward the second end of the containment. According to a preferred embodiment, the solar receiver of the invention can be integrated with a parabolic collector, thermal energy storage, heat engine, recuperator, waste heat radiator, and alternator/generator modules to give a complete solar dynamic power system having significant adavantages in compactness and weight/power ratio. 3 figs.

1409 Solar Thermal Utilization

18246 (ENET–8900296/1) **Zero energy house in Oberburg.** Marti, K. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). 1990. 13p. (In German). Order Number DE92515345. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The Burgdorf Engineering School is taking thermal and electrical measurements in the solar systems of a zero energy house on behalf of the Swiss Federal Office of Energy. The size of the solar systems is such that they can cover all the basic requirements of the house residents. In the winter semester 1989/90 the expectations were completely met; some 9.43 MWh of heat energy was gathered by the collectors and the hot water treatment system for the heating used some 3.79 MWh. The heat losses from the three storage devices amounted to 6.09 MWh. The energy of 6.41 MWh which is stored in the large storage devices during the summer was not required. The house has extraordinarily good insulation and is also suitable for the passive use of solar energy. The energy index for the heating system is 67 MJ/m^2a. The solar systems in the zero energy house do not offer very high efficiency levels which can be explained by their insular operation which not allows the use of excess energy. (author) 11 figs.

18247 (ENET–8990007/1) **Solar architecture: Annual report of a research programme of the Swiss Federal Office of Energy.** Hastings, R.; Reufer, F. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Dec 1990. 130p. (In German). Order Number DE92515356. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

This article reports on the work completed during 1990 in the following fields: solar facades and roofs, the use of daylight, solar applications in non-residential buildings, projects which tackle several problems at once and international collaboration. figs., tabs., refs.

18248 (NEI-DK–806) **Measurment and evaluation of a 44 m^2 low-flow solar heating system at Soenderborg school of navigation.** Esbensen Raadgivende Ingenioerer, Soenderborg (Denmark). Aug 1991 50p. (In Danish). Contract TR-88.614. Order Number DE92506343. Source: OSTI; NTIS (US Sales Only).

Measurements of output have been made on a low-flow/single-pass solar heating system located at the school of navigation in Soenderborg, Denmark. This system had a heat loss of 54.000 kWh through the circulation network. The system has solar collectors of 44 square meters and a 2000 liters storage capacity. The circulation system starting from the hot water runs through the solar heat storage unit so that this heat can be used to cover heat losses from the network and so that boiling will be prevented. Using measurements from solar incidence, temperatures and flow, a computerized simulation of the solar heating has been constructed. It was found that the yield was 4.7% higher than that of a traditional non-low-flow system. It was discovered that a lower yield in relation to the time period was due to the fact that stratification in the heat storage container was destroyed during the night because of mixing due to the large volume of through-flow. Measurements showed that the system initiated can cover heat loss from the circulation system at a temperature level of 55-60 degrees centigrade. (AB).

18249 (NEI-DK–816) **Solar collector house on the roof of an apartment building: Draft project.** Cowiconsult Raadgivende Ingenioerer A/S, Lyngby (Denmark). Jan 1992 23p. (In Danish). Contract ENS-UVE-90.0121. Order Number DE92506356. Source: OSTI; NTIS (US Sales Only).

The aim was to construct a glass building (which could be used for recreational purposes) in combination with a built-in air-type solar collector on the roof of an apartment building located in the centre of Copenhagen, Denmark. The solar collector was to used for water heating with regard to communal facilities in the cellar, and for heating the glass building. The solar collector is constructed in such a way that the sun's rays can be utilized coming from both sides. The design of the glass construction is described and illustrated, and its ventilation system is explained. The energy yield from the solar collector, the temperatures of the glass building throughout the year and the production and use of energy to the hot water tank are described. As it proved difficult to fix the building onto the roof, it was concluded that where possible in other cases it might be better to construct it on the ground. The overall cost was in this case 800,000 Danish crowns, answering to 25,000 crowns per flat. The amount of annual energy produced was 135,000 kWh amounting to an annual saving of 7,000 crowns. The residents enjoyed the extra recreation facility. (AB).

18250 (TKK-F–A669) **SOLCHIPS - A fast predisign and optimization tool for solar heating with seasonal storage.** Lund, P.D.; Peltola, S.S. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1991. 31p. Order Number DE92506509. Source: OSTI; NTIS (US Sales Only).

A new version of the SOLCHIPS predisign and optimization tool for solar heating systems with seasonal storage is described. The tool comprises a user friendly interface with a minimal input requirement. The tool is here applied to the redesign of an existing solar heating installation and to the predesign of a completely new solar plant. The evaluation and dimensioning of one CSHPSS configuration can now be done in 10 to 20 seconds thus enabling fast optimization in respect to several parameters. A case study of an existing CSHPSS plant shows a 50 % decrease in the annual energy price when the system is redesigned using the SOLCHIPS tool.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 18238, 18244, 18793

1420 Heat Storage

18251 (DTH-LV–91-21) **Low-flow solar heating system with a hot water container and an external heat exchanger.** Fagerlund Carlsson, P.; Furbo, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Dec 1991. 25p. (In Danish). Contract ENS-51181-91.0031. Order Number DE92506375. Source: OSTI; NTIS (US Sales Only).

Measurements were taken on an indoor heat storage capacity where the heat exchange between the solar collector and the hot water container took place through an external heat exchanger. The heat storage facility was tested as a part of a smaller solar heating system. A heat storage capacity was built up which, with the help of natural circulation, led the heated liquid from the heat exchanger up into the hot water container so that a satisfactory arrangement of temperature layers was achieved. The heat storage facility was tested in connection with a 4 square meter solar collector and during a 7-week period the system yielded 110 kWh which was lower than that where an enclosed container system was used. It was also found that a heat storage facility with and external heat exchanger was more expensive to run. (AB).

18252 (DTH-LV-MEDD–219) **Experimental borehole heat storage and conversion of a duct storage facility to gravel pit storage.** Ussing, V. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Feb 1991. 125p. (In Danish). Contract ENS-UVE-90.0052. Order Number DE92506376. Source: OSTI; NTIS (US Sales Only).

Investigations had pointed to an expected applicability of duct storage as seasonal storage in collective solar plants. Testing of a 540 m^3 test pit, a waterfilled gravel pit functioning as an artificial acquifer as well as a pipecoil operated gravel pit storage took place. In order to study the heat transfer in the bore-hole core a laboratory test arrangement was built, and tests with dry and moist sand fill as well as concrete fill were run. Measuring of arrangements for the test drill hole storage (1260 m^3, 18 m depth) operation of the gravel pit using the pipe coil (1006 m 12 mm PEX-pipe) for heat transfer allowed indication of the average temperature of the gravel pit storage as well as of the stratification. An alternative measuring system indicated the temperature distribution around a single point of the heat transfer coil in the saturated gravel. The test duct storage was designed with a depth of 18 m and included 7 0.4 m boreholes in a hexagonal pattern spaced 3,4 m apart. 8 bore-holes were equipped with a string of 8 thermoelements. All holes were filled with sand. Temperatures measured in the upper 5 m (clay) of the storage were several degrees above the temperatures measured in the lower 13 m. The heat loss during the first four years exceeds the heat loss of the fifth and following years. Though the thermal efficiency of a duct storage improves with increasing diameters of the boreholes and the drilling cost only increases slightly, the cost of filling the boreholes limits the advantages of using large diameter holes. It appears that boreholes with 3-Upipe cobber tubes and a concrete fill will give the most effective heat transfer. (AB) 12 refs.

18253 (PNL-SA–19467) **Chemical energy storage system for SEGS solar thermal power plant.** Brown, D.R.; LaMarche, J.L.; Spanner, G.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920429–2: International solar energy conference, Honolulu, HI (United States), 4-8 Apr 1992). Order Number DE92012327. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest Laboratory evaluated the potential feasibility of using chemical energy storage at the Solar Electric Generating System (SEGS) power plants developed by Luz International. Like sensible or latent heat energy storage systems, chemical energy storage can be beneficially applied to solar thermal power plants to dampen the impact of cloud transients, extend the daily operating period, and/or allow a higher fraction of power production to occur during high-valued peak demand periods. Higher energy storage densities make chemical energy storage a potentially attractive option. The results of the evaluation indicated that a system based on the reversible reaction, $CaO + H_2O = Ca(OH)_2$, could be technically and economically feasible for this application, but many technical and economic issues must be resolved.

1440 Legislation and Regulations

18254 (NEI-DK–833) **Plan of management for solar energy.** Energistyrelsen, Copenhagen (Denmark). Solenergiudvalget. Dec 1991 34p. (In Danish). Order Number DE92506467. Source: OSTI; NTIS (US Sales Only).

The committee for solar energy, set up by the Danish Ministry of Energy, claims that it should be possible in the future for solar energy to cover the total Danish energy needs. Practical means of achieving this end are briefly discussed, and probable constraints are exemplified. The Danish 3-year plan of management in this area for 1992-94 is to develope solar heating systems and the utilization of passive solar energy to the point where the total subsidies of 20 million kroner for the installation of new systems would no longer be needed. The aim of the plan would be to improve the solar energy systems in such a way that they could be an attractive investment for individual users. The quality of these systems should be assured in order that the service-life would be longer, operational costs lower and yields higher. It is pointed out that individual economies do not at present incite major investments in solar energy systems. Information to the public should be intensified, and promotive projects should be carried out. The potentials of solar cells are briefly discussed. Tables and graphs illustrate the theme. (AB) 10 refs.

15 GEOTHERMAL ENERGY

Refer also to citation(s) 18633, 18728

1501 Resources and Availability

Refer also to citation(s) 18621

18255 (LA-UR–92-978) **HDR opportunities and challenges beyond the long-term flow test.** Duchane, D.V. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920378–1: Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market, San Francisco, CA (United States), 24-26 Mar 1992). Order Number DE92011234. Source: OSTI; NTIS; GPO Dep.

The long term flow test (LTFT) of the world's largest, deepest, and hottest hot dry rock (HDR) reservoir currently underway at Fenton Hill, NM, is expected to demonstrate that thermal energy can be mined from hot rock within the earth on a sustainable basis with minimal water consumption. This test will simulate the operations of a commercial facility in some ways, but it will not show that energy from HDR can be produced at a variety of locations with different geological settings. Since the Fenton Hill system was designed as a research facility rather than strictly for production purposes, it will also not demonstrate economic viability, although it may well give indications of system modifications needed for economic HDR operations. A second production site must be constructed, ideally under the direction of the private geothermal community, to begin the process of proving that the vast HDR resources can be accessed on a worldwide scale. Finally, research and development work in areas such as reservoir interrogation, and system modeling must be accelerated to increase the competitiveness and geographical applications of HDR and the geothermal industry in general. This paper addresses the above issues in detail and outlines possible paths to future prosperity for the commercial geothermal industry.

1502 Geology and Hydrology of Geothermal Systems

Refer also to citation(s) 19480

18256 (DOE/ER/14049–T2) **[Energy related studies utilizing microline thermochronology]: Progress report, 1986–1989.** California Univ., Los Angeles, CA (United States). [1989]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER14049. Order Number DE92012579. Source: OSTI; NTIS; GPO Dep.

The past two years of research conducted have been fruitful and exciting. Using Microcline Thermochronology (MTC), we have investigated the hydrothermal maturity of the Salton Sea Geothermal Field, potential for hydrocarbon maturation associated with heating due to ridge subduction beneath accretionary prism sediments, developed a single crystal dating system which has proven to greatly enhance interpretations regarding MTC, and also have begun to develop sound theoretical and experimental techniques which truly revolutionize our understanding of argon systematics in K-feldspars.

1503 Geothermal Exploration and Exploration Technology

18257 (DOE/ER/14083–1) **Tensor controlled-source audiomagnetotelluric survey over the Sulphur Springs thermal area, Valles Caldera: Annual report.** Wannamaker, P.E. Utah Univ. Research Inst., Salt Lake City, UT (United States). Earth Science Lab. Oct 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14083. (ESL–91023-TR). Order Number DE92010950. Source: OSTI; NTIS; GPO Dep.

The extensive tensor CSAMT survey of the Sulphur Springs geothermal area, Valles Caldera, New Mexico, consists of 45 high-quality soundings acquired in continuous-profiling mode and has been funded in support of CSDP drillholes VC-2A and VC-2B. Two independent transmitter bipoles were energized for tensor measurements using a 30 KW generator placed approximately 13 km south of the VC-2B wellhead. These current bipoles gave source fields over the receiver sites which were substantially independent in polarization and provided well-resolved tensor elements. The surroundings in the Sulphur Springs area were arranged in four profiles to cross major structural features. At each receiver, two orthogonal electric and three orthogonal magnetic field components were acquired in accordance with tensor principles. Derivation of model resistivity cross sections from our data and their correlation with structure and geochemistry are principal components of the OBES award. However, Sulphur Springs also can serve as a natural testbed of traditional assumptions and methods of CSAMT with quantification through rigorous model analysis. Issues here include stability and accuracy of scalar versus tensor estimates, theoretical versus observed field patterns over the survey area, and controls on near-field effects using CSAMT and natural field data both inside and outside the caldera.

1505 Economic, Industrial, and Business Aspects

Refer also to citation(s) 18260, 18621

1508 Geothermal Power Plants

18258 (LA-UR–92-1237) **Start-up operations at the Fenton Hill HDR Pilot Plant.** Ponden, R.F. Los Alamos National Lab., NM (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920378–3: Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market, San Francisco, CA (United States), 24-26 Mar 1992). Order Number DE92013544. Source: OSTI; NTIS; GPO Dep.

With the completion of the surface test facilities at Fenton Hill, the Hot Dry Rock (HDR) Geothermal Energy Program at Los Alamos is moving steadily into the next stage of development. Start-up operations of the surface facilities have begun in preparation for testing the Phase II reservoir and the initial steady-state phase of operations. A test program has been developed that will entail a number of operational strategies to characterize the thermal performance of the reservoir. The surface facilities have been designed to assure high reliability while providing the flexibility and control to support the different operating modes. This paper presents a review of the system design and provides a discussion of the preliminary results of plant operations and equipment performance.

1509 Geothermal Engineering

Refer also to citation(s) 18258

1520 Geothermal Data and Theory

18259 (CONF-920761–6) **Possible evidence for fluid-rock oxygen isotope disequilibrium in hydrothermal systems.** Cole, D.R. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92010641. Source: OSTI; NTIS; GPO Dep.

There is ample evidence from geothermal systems that isotope temperatures estimated from the oxygen isotope fractionation between alteration phases and coexisting aquifer fluids agree closely with measured bore-hole temperatures. Similar, but limited evidence is found in epithermal vein deposits where isotopes temperature agree well with fluid inclusion homogenization temperature. Conversely, many hydrothermal systems exhibit varying degrees of fluid-rock oxygen isotope equilibration. There appears to be a crude relationship between increasing degree of equilibrium and increasing temperature and salinity. The observed variations in the degree of exchange may have resulted from local, self-sealing of the fracture network prior to equilibration. The ability for fracture to remain open or to propogate allowing continued fluid flow may be the deciding factor in the attainment of isotopic equilibration.

18260 (DOE/SF/17712–T2) **UCSD Geothermal Chemical Modeling Project: DOE Advanced Brine Chemistry Program: Final report, June 1988–December 1991.** Moeller, N.; Weare, J.H. California Univ., San Diego, La Jolla, CA (United States). Dept. of Chemistry. Apr 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-88SF17712. Order Number DE92013525. Source: OSTI; NTIS; GPO Dep.

DOE funding to the UCSD Chemical Modeling Group supports research to provide computer models which will reliably characterize the equilibrium chemistry of geothermal brines (solution, solid and gas phases) under variable thermodynamic conditions. With this technology, it will be possible to rapidly and inexpensively predict the chemical behavior of geothermal brines during various resource recovery stages; exploration, production, plant energy extraction and rejection as well as in ancillary programs such as mineral recovery. Our modeling technology is based on recent progress in the physical chemistry of concentrated aqueous solutions. The behavior of these fluids has not been predicted from first principle theories. However, because of the importance of concentrated brines to many industrial and natural processes, there have been numerous efforts to develop accurate phenomenological expressions for predicting the chemical behavior of these brines. One of the most successful of these efforts is that of Pitzer and coworkers. Incorporating the semiempirical equations of Pitzer, we have shown at UCSD that we can create highly accurate models of brine-solid-gas chemistry.

16 TIDAL AND WAVE POWER

Refer also to citation(s) 18633

17 WIND ENERGY

Refer also to citation(s) 18633, 18728

1701 Resources and Availability (Climatology)

18261 (NUTEK-VIND–92-1) **A climatological study of wind power potential in the Blekinge area.** Bergstroem, H. (Uppsala Univ. (Sweden). Dept. of Meteorology). NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1992. 74p. Project NUTEK-506-226. Order Number DE92506590. Source: OSTI; NTIS (US Sales Only).

There is great need for models in order to be able to get more detailed information regarding the horizontal and vertical variation of the wind. A mesoscale higher order closure atmospheric boundary layer model has been used to get this type of information in an area in south-eastern Sweden. This type of model is quite computer time consuming. As the number of model runs had to be kept at a minimum, the factors primarily affecting the wind field was identified. It was rendered necessary to make simulations representing the four seasons, 8 wind directions, three geostrophic wind speeds, and three mean temperatures over land, while the sea surface temperature was kept at its monthly average. The model was run for these 288 conditions with the monthly mean of the daily temperature variation to include the effects of the thermal stratification. 24 hours of simulated data were stored from each simulation. A comparison between the modelled climatological mean wind and the observations at three weather stations showed good agreement both as regards monthly and annual data. The potential wind energy production in the area was estimated from the modelled wind and was over the open sea found to be about 20% higher compared to earlier investigations. Closer to the coast the present model simulations show, however, a somewhat lower mean wind speed than the earlier studies, thus giving a 10-20% decrease of the potential energy production in these areas as compared to previous results. The present investigation thus gives a larger difference in wind energy potential between the open sea and the coastal zone. 39 refs.

1704 Economic, Industrial, and Business Aspects

18262 (RISO-M–2927) **WEP. A wind energy planning system: User's manual.** Larsen, H.V. Risoe National Lab., Roskilde (Denmark). Systems Analysis. Nov 1991. 71p. Order Number DE92506340. Source: OSTI; NTIS (US Sales Only); INIS.

The report describes the Wind Energy Planning system (WEP). It is intended as a decision support system to be used in the economic evaluation of wind energy projects. Such projects could be minor projects with only a single wind turbine or large wind farm projects consisting of several wind turbine plants. In the WEP system, a wind turbine is described by data on initial investment, possible later reinvestments, O and M costs, expected yearly production, life time, and capacity factor. The raising of loans are modelled, too. Depending on which output report is created, the value of the wind generated electricity is calculated in two different ways: either the electricity is assumed to be sold at a price (time series) given by the user, or the alternative conventional power production is modelled by its specific investment, O and M costs, life time, effectivity, fuel mix, and time series for fuel prices. Using these data, capacity credit and saved fuel and O and M costs are calculated. Due to the flexible data structure of the model, the user can easily create a scenario that models a large scale introduction of wind power. In such a scenario the gradual build up through several years of the wind power capacity can be modelled. The report describes in detail the menu structure, the input facilities, the output reports, and the organization of data. Also included is an example with full input documentation and output reports. (au).

1706 Wind Energy Engineering

18263 (AUC-IBT-R–9202) **Fatigue tests on laminated wood beams: Partial report 5: Testing of series D.** Pilegaard Hansen, L.; Rathkjen, A. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Jan 1992. 45p. (In Danish). Contract TR-88.1040;Contract ENS-51171-91.0004. Order Number DE92506391. Source: OSTI; NTIS (US Sales Only).

A detailed description of fatigue tests made on beams of laminated wood which should be used for the manufacture of wind turbine blades. The text is illustrated by photographs, tables and graphs. (AB).

18264 (IFE/KR/E–92/001) **Windpower activity in 1991 at IFE: Annual report.** Nygaard, T.A.; Tallhaug, L. Institutt for Energiteknikk, Kjeller (Norway). Jan 1992. 42p. (In Norwegian). Order Number DE92506558. Source: OSTI; NTIS (US Sales Only).

The present report deals with a wind power research program in 1991 in Norway. The program mainly concerns the location of wind turbines, wind measurements, operation of models for wind loads above the terrain, and pre-projects for apart standing wind turbines and turbine parks. In addition, the program comprises an evaluation of environmental conditions in connection with wind energy utilization and a master plan for wind power development in the county of Soer- Troendelag. 16 refs., 11 figs., 8 tabs.

18265 (NEI-DK–797) **Windmills: Proposal for the regional plan supplement no 5 for Roskilde administrative area.** Roskilde Amt (Denmark). Teknisk Forvaltning. Jan 1992 32p. (In Danish). Order Number DE92506334. Source: OSTI; NTIS (US Sales Only).

Denmark, it is claimed, is one of the countries in which the extent of emission of carbon dioxide is greatest per individual. The overriding policy of the Danish government is to attempt to reduce air pollution by increasing use of renewable energy sources, especially in the case of wind power. It is planned that by the year 2005 wind turbine systems should be installed to the effect of 1500 MW. The National Agency for Physical Planning has pointed out, in cooperationn wiht local authorities and the Danish electricity companies, areas for the future location of wind turbines taking, amongst other aspects, legislation, nature conservation and other environmental aspects into consideration as well as wind resources and distribution networks. Suggestions for location of possible wind turbine arrays are also given. Maps illustrating these aspects, and constraints such as air routes etc., within the administrative area of Roskilde are presented. (AB).

18266 (NEI-DK–813) **Adaptive pitch control for wind turbines.** Eksamensprojekt - IMSOR, 26/91. Klingenberg, B. Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Mathematical and Operations Research. 1991 129p. Order Number DE92506357. Source: OSTI; NTIS (US Sales Only).

The application of wind energy conversion systems for the production of electrical energy requires a cheap and reliable operation. The main goal of the study described in this report is to develop a pitch control law for a wind turbines. The wind turbine system under investigation has a three-bladed rotor which is connected to the generator by a transmission. The wind power plant is connected to a large utility grid. The power in the wind increases roughly as the cube of the wind speed. At a predetermined wind speed the power input to the wind turbine will have reached rated power, and the excess power in the wind must be discarded by the rotor to prevent the turbine overloading. The control design problem at full load is to limit the power output to rated power and to minimise fluctuations in produced electromechanical torque. The control system should realise this without excessive use of the input variable and must also be simple to implement. In order to be able to design a high performing control system, the system dynamics and the wind characteristics are studied. A model for simulation and control design purpose is presented. An adaptive pitch angle control system is proposed. The adaptive control system is realised as a direct adaptive system. The control design problem is solved using linear optimal controllers based on the input-output approach. The stochastic pole placement controller is found to be the most suitable controller. Various estimations schemes were tested when solving the estimation problem - among others Pseudo Linear Regression and Recursive Maximum Likelihood estimation. None of the estimation schemes gave satisfactory results. (au) 19 refs.

18267 (NEI-DK--840) **Final report for the 55 kW wind turbine on Anholt.** Elsamprojekt A/S, Fredericia (Denmark). Feb 1992 57p. Contract EM-151/86-27. Order Number DE92506471. Source: OSTI; NTIS (US Sales Only).

EFP-86.

Anholt is a small island with approx. 70 households. It is situated in the middle of Kattegat, about 50 km north east of the city of Grenaa. During the summer period, the elctricity consumption grows considerably due to the many tourists visiting the island. The load pattern is therefore atypical compared to other systems. The maximum load is approx. 500 kW and the minimum is 50 kW. There is no connection to the electric system on the mainland. The purpose of the project is to demonstrate that a series-produced standard wind turbine is able to co-operate with diesel generator sets in an isolated power system and contribute to the power supply of the area with a minimum of extra control equipment. The control/measuring system has been active for 11773 hours during the reporting period. The wind turbine has been producing 116,421 kWh in 5200 hours during the period, which gives an average output of 22.4. (au).

18268 (SL--87835) **Evaluation of previous wind-tunnel, studies at DMI concerning the influence of buildings on the energy production of wind turbines: Technical note.** Ingham, P. Skibsteknisk Laboratorium, Lyngby (Denmark). Sep 1987. 39p. Contract EM-1364/87-4. Order Number DE92506390. Source: OSTI; NTIS (US Sales Only).

EFP-87; EFP-88.

The background for this note is the description of job A - 1a in research project: "Siting of Wind Turbines near Buildings and Obstacles". The scope of this note is to evaluate previous relevant work carried out in the area by the Danish Maritime Institute (DMI). In the report SL 84913, there is given a wind-tunnel investigation of the influence from buildings and obstacles on the power content in the flow. Four types of buildings in the scale ratio 1:100 were studied in a boundary-layer wind tunnel. The change in the power content of the flow caused by the models was studied in simulated boundary layers, which correspond to full-scale boundary layers. It is specifically the nearfield in front and behind the buildings, which is investigated in the report. The report shows that the essential influence on the power content from the building is in the nearfield 20 house heights in front and behind the building. (au).

18269 (SV-UD--91-56) **Localization study - 300 MW wind power.** Grusell, G. (Vattenfall Energisystem AB, Vaellingby (Sweden)). Vattenfall Utveckling AB, Vaellingby (Sweden). 26 Sep 1991. 105p. (In Swedish). Order Number DE92506567. Source: OSTI; NTIS (US Sales Only).

The present study aims at identifying areas in the Vattenfall distribution areas that are suitable for the establishment of a 300 MW wind power development. This study has investigated suitable onshore sites for the construction of one hundred 3 MW wind power plants. Basic data for the study has also been obtained from country administrations, municipalities, local energy companies, the Swedish Meteorological and Hydrological Institute and various sector authorities. With a minimum distance of 300 m to the nearest buildings, the total potential within the areas studied are calculated to be approximately 1.5 TWh/year or some 250 units. Each area has been assessed on the basis of both its potential electric energy production and the average production cost. When ranking areas for the first 100 wind power units in order of priority, consideration has been given in the first instance to the availability of wind and the electricity production cost. The report proposes that the 100 wind power units should be localized in 9 wind power groups in the counties of Gotland, Halland, Gothenburg and Bohus. An extension along these lines is calculated to give an electric energy production of 0.7-0.8 TWh/year. With a manufacturing capacity of 15 units a year, the report estimates the implementation period for the first serie to be 14 years from the start of a preliminary study. The electricity production cost for this serie with 100 wind power units has been calculated to be between 50 and 75 oere/kWh (approx 0.08-0.12 USD/kWh). This calculation is based on second generation wind power units that have not yet been fully developed. Development work will from now on be directed mainly towards bringing these costs down to a competitive level compared with techniques based on similar environmental data.

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 17751, 17758, 17771, 17809, 17810, 18171, 18673, 18776

18270 (CONF-9103215--, pp. 199) **Integrated resource recovery: Combustion of RDF in a fluidized bed boiler.** Murphy, M.L. (Energy Products of Idaho, Coeur d'Alene (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

A comprehensive plan for solid waste management including recycling and reuse as well as fluid bed combustion of the refuse derived fuel provides the best possible means of solving the pending crisis with this nations' waste. This paper addresses the magnitude of the problem and presents some specific design information pertaining to combustion of refuse in an EPI fluid bed system. In all instances, emissions from the fluid bed have been demonstrated to meet the proposed EPA New Source Performance Standards.

18271 (CONF-9103215--, pp. 201-202) **Using the personal computer to create bioenergy information databases: An information model on systems for using medium-Btu pyrolysis gas as a fuel for small gas turbines.** Keown, W.H. (Pennsylvania State Univ., Dubois (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

An easily accessed bioenergy database is described that was created from public-domain and 'shareware' programs. It was used to document and describe an innovative energy system concept for effectively using the high-quality, medium-Btu gas from the pyrolysis of wood residues and organic waste materials as a supplementary fuel for small gas turbines. These light-weight engines are suitable for installation on mobile power units. They can provide electric power, process heat, steam, and shaft power to meet remote-site energy needs of forest-based industries.

18272 (DOE/MC/23167--3056) **Advanced coal-fueled gas turbine systems reference system definition update.** Westinghouse Electric Corp., Orlando, FL (United States). Sep 1991. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC23167. Order Number DE92001119. Source: OSTI; NTIS; GPO Dep.

The objective of the the Direct Coal-Fueled 80 MW Combustion Turbine Program is to establish the technology required for private sector use of an advanced coal-fueled combustion turbine power system. Under this program the technology for a direct coal-fueled 80 MW combustion turbine is to be developed. This unit would be an element in a 207 MW direct coal-fueled combustion turbine combined cycle which includes two combustion turbines, two heat recovery steam generators and a steam turbine. Key to meeting the program objectives is the development of a successful high pressure slagging combustor that burns coal, while removing sulfur, particulates, and corrosive alkali matter from the combustion products. Westinghouse and Textron (formerly AVCO Research Laboratory/Textron) have designed and fabricated a subscale slagging combustor. This slagging combustor, under test since September 1988, has been yielding important experimental data, while having undergone several design iterations.

18273 (DOE/MC/23167–3065) **Advanced coal-fueled gas turbine systems: Annual report, July 1990–June 1991.** Westinghouse Electric Corp., Orlando, FL (United States). Power Generation Business Unit. Sep 1991. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC23167. Order Number DE92001145. Source: OSTI; NTIS; GPO Dep.

The combustion system discussed here incorporates a modular three- stage slagging combustor concept. Fuel-rich conditions inhibit NO_x formation from fuel nitrogen in the first stage; also in the first stage, sulfur is captured with sorbent; coal ash and sulfated sorbent are removed from the combustion gases by inertial means in the second stage by the use of an impact separator and slagging cyclone separator in series. Final oxidation of the fuel-rich gases, and dilution to achieve the desired turbine inlet conditions are accomplished in the third stage, which is maintained sufficiently lean so that here, too, NO_x formation is inhibited. The objective of this contract is to establish the technology required for subsequent commercial development and application by the private sector of utility-size direct coal-fueled gas turbines. Emissions from these units are to meet or be lower than the Environment Protection Agency's (EPA's) New Source Performance Standards (NSPS) for a pulverized coal-=fired steam turbine generator plant.

18274 (DOE/MC/26019–3071) **Assessment of coal gasification/hot gas cleanup based advanced gas turbine systems: Greenfield assessment: Final report.** Southern Co. Services, Inc., Birmingham, AL (United States). Research and Environmental Affairs Dept. Dec 1991. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26019. Order Number DE92001254. Source: OSTI; NTIS; GPO Dep.

Both the KRW fluidized-bed gasifier and the transport gasifier case studies were used for this assessment. The transport technology is a high-velocity circulating fluidized-bed reactor currently under development by The M.W. Kellogg Company. In the earlier assessment, seven design concepts or cases were identified; a process design was developed; major equipment items were identified; estimates of capital cost, operation and maintenance cost, and cost of electricity were developed; reliability was predicted; and development issues were identified for six studies. Three of the most probable cases were further evaluated for a Greenfield assessment in this report to adequately determine all costs independent of facilities at Plant Wansley.

18275 (ETDE-IT–92-34) **Utility power plant off-peak energy storage.** Grattieri, W.; Rivoiro, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica. Dec 1991. 10p. (In Italian). (CONF-9106352–1: Giornata di studio 'Distribuzione 2000', Pisa (Italy), Jun 1991). Order Number DE92506261. Source: OSTI; NTIS (US Sales Only).

This paper examines the technical and cost feasibility of three energy storage schemes which electric utilities could apply to their fuel oil or gas fired power plants as alternative solutions to shut down during periods of low demand. Two of these schemes involve the use of the energy produced during night-time operation to operate cold storage and water heating systems to help satisfy local day-time building space heating and air conditioning requirements. The other alternative involves the feeding of night-time produced energy to a system of storage batteries coupled with an dc/ac inverter.

18276 (IVO-B–11/91) **The factors effecting on the efficiency of power plants.** Raiko, M.; Lyytikaeinen, R.; Vessonen, K.; Mielonen, P. Imatran Voima Oy (IVO), Helsinki (Finland). 1991. 66p. (In Finnish). Order Number DE92506511. Source: OSTI; NTIS (US Sales Only).

The use of fuel energy content as good as possible is decisively important to the operation economy of power plants. Fuels costs make up generally half or more the operating life costs in power plants which use fossil fuels. The high efficient use of fuel is more and more important also because emission limits are constantly being tightened and emission taxes are increasing. This report presents the basic definations of the efficiency of power plant for instance boiler efficiency, piping efficiency, steam turbine efficiency, generator efficiency, consumption ratio and the losses of different process component and the factors effecting on the losses. The report also presents some of the losses of fluegas desulphurisation and NOx-reduction and how measuring and control engineering effect on the efficiency of power plant and what efficiency means to the production costs.

18277 (LUTMDN-TMVK–5208-1-74-91) **Optimization of a gas turbine cogeneration plant.** Wallin, J.; Wessman, M. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Nov 1991. 71p. (In Swedish). Order Number DE92506565. Source: OSTI; NTIS (US Sales Only); INIS.

Examination paper.

This work describes an analytical method of optimizing a cogeneration with a gas turbine as prime mover. The method is based on an analytical function. The function describes the total costs of the heat production, described by the heat load duration curve. The total costs consist of the prime costs and fixed costs of the gas turbine and the other heating plants. The parameters of interest at optimization are the heat efficiency produced by the gas turbine and the utilization time of the gas turbine. With todays prices for electricity, fuel and heating as well as maintenance- personnel and investment costs, extremely good conditions are needed to make the gas turbine profitable. Either a raise of the price for the electricity with about 33% is needed or that the ratio of electricity and fuel increases to approx 2.5. High investment subsidies for the gas turbines could make a gas turbine profitable, even with todays electricity- and fuel prices. Besides being a good help when projecting cogeneration plants with a gas turbine as prime mover, the method gives a possibility to optimize the annual operating time for a certain gas turbine when changing the operating conditions. 6 refs.

18278 (NEI-DK–826) **Pilot project for coal gasification Enstedvaerket blok 3: Summary of final report.** Soenderjyllands Hoejspaendingsvaerk, Aabenraa (Denmark); Jyak-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark). [1991] 67p. (In Danish). Order Number DE92506462. Source: OSTI; NTIS (US Sales Only).

In cooporation with PreussenElketra.

A detailed description of the design and operation of a plant for the demonstration of integrated coal gasification with combined cycle in relation to power plants is presented. The advantages of such plants are the possibility for also using fuel cells (meaning higher efficiency and less pollutive emissions), lower SO_2 and SO_x and dust emission, less waste products (which can also be utilized afterwards) the possibility for producing methanol as well as electricity, reduced need of cooling water and the same price as conventional power plants. It is reckoned that a boosting system can be built for 1.5-1.8 billion Danish crowns and calculated that such a plant with its own turbine would have a yield of up to 200 MW, the efficiency would be improved by 40.9% - 46% and it could be built for ca. 2 billion Danish crowns. Relevant data and illustrative diagrams are also presented. (AB).

18279 (SV-UB–91-62) **The Vega project: Report on the pilot study.** Aronsson, I. (Vattenfall Energisystem AB, Vaellingby (Sweden)). Lund Univ. (Sweden). Div. of Atomic Physics; Vattenfall Utveckling AB, Vaellingby (Sweden). 25 Oct 1991. 30p. (In Swedish). Order Number DE92506568. Source: OSTI; NTIS (US Sales Only).

The Vega project is the name of a project which started in December 1990. Vega was chosen as the name of the process being studied, namely pressurized gasification of biofuels integrated with a combi-cycle. Pressurised gasification of biofuels for electricity generation in gas turbines/steam turbines is an interesting alternative for the future. The technique is assessed to be extremely environmentally considerate and gives a high output of electricity.

The technique can be built for production of both power and cogeneration of power and district heating. The pilot study is based on a fuel consisting of wood, bark and forest waste. Access to fuel and suitable gas turbines may be limiting factors. Economically interesting plant sizes are considered to be from 30-40 MW_{el} and larger. Other types of high-reactive fuel, such as peat and brown coal, can be used in plants with a fairly similar design. In condenser power stations, a plant with 140 MW fuel input is considered to give an electricity output of 67 MW (48 % LHV), while a cogeneration power station is expected to provide 61 MW_{el} (44 % LHV) and 65 MW heat (46 % LHV). Another interesting type of production for this plant is condensation with bleeding. In this case, the output is 67 MW_{el} and 23 MW heat. These very good efficiencies are expected to be even better in larger plants.

2002 Waste Management

Refer also to citation(s) 17770, 17778, 17780, 17781, 17782, 17783, 17785, 17788, 17789, 17790, 17791, 17792, 17793, 17794, 17795, 17796, 17797, 17798, 17799, 17800, 17818, 17820, 17821, 18128, 19426, 19447

18280 (IVO-B–12/91) **Leachability and toxicity of flue gas desulphurization products and coal fly ash.** Siitonen, T. Imatran Voima Oy (IVO), Helsinki (Finland). 1991. 64p. (In Finnish). Order Number DE92506513. Source: OSTI; NTIS (US Sales Only).

In flue gas desulphurization processes of coal-fired power plants great amounts of solid wastes and fly ash are formed. The composition of these wastes is mostly dependent on the coal burned, combustion conditions and the quality of the absorbent used in desulphurization process. The amounts of different trace elements are generally smaller in desulphurization products than in fly ash. Greatest amounts of different trace elements are accumulated to the sludge from the waste water process. The main dissoluble species are sulphates, calsium, chlorides, sodium and potassium. The leachability of boron is higher from the fly ash than from other wastes. Other high measured contents are chromium in fly ash and wet-dry desulphurization product and arsenic and mercury in sludge. Fly ash is found mutagenic in toxicity tests. Fgd-gypsum is not mutagenic. Leaching waters of fly ash, sludge and product of wet-dry process are acutely toxic to water flea Daphnia magna. Leaching water of fgd-gypsum is not toxic according to the standard test method.

2005 Environmental Aspects

Refer also to citation(s) 18224, 18225, 18284, 18627

18281 (DOE/EIS–0131-Vol.1-Final) **Initial Northwest Power Act power sales contracts: Final Environmental Impact Statement: Volume 1, Environmental analyses.** USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1992. 247p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012663. Source: OSTI; NTIS; GPO Dep.

This is volume 1 of the final environmental impact statement of the Bonneville Power Administration Information is included on the following: Purpose of and need for action; alternatives including the proposed action; affected environment; and environmental consequences.

18282 (DOE/EIS–0162-Summ.) **Resource programs, Draft Environmental Impact Statement: Summary.** USDOE Bonneville Power Administration, Portland, OR (United States). Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). (DOE/BP–1818). Order Number DE92011117. Source: OSTI; NTIS; GPO Dep.

The Resource Program (RPEIS) is a programmatic document which covers broad issues associated with resource acquisitions. The environmental impact statement (EIS) evaluates the environmental trade-offs among generic resource types and the cumulative effects of adding various combinations of these resources to the existing system. Before analyzing the actions Bonneville Power Administration (BPA) could take to meet the underlying need, the RPEIS evaluates the environmental effects of generic resource types and potential mitigation measures for each. Current supply curve analysis indicates that the following resource types could be available to meet future load growth through 2010: conservation; renewable resources; cogeneration; combustion turbines; nuclear power; and coal. Other means of meeting load, such as fuel switching from electricity to natural gas for space and water heating, energy imports, and efficiency improvements, are also evaluated. Emerging technologies that could become commercially available within the planning period, and various types of load management, have been included as well.

18283 (NEI-DK–842) **Utilization of operation profiles for the calculation of air quality with regard to power plants: Final report.** Elsamprojekt A/S, Fredericia (Denmark). Sep 1990 41p. (In Danish). Order Number DE92506461. Source: OSTI; NTIS (US Sales Only); INIS.

One aim was to investigate and explain the nature of the problems related to the use of operation profiles using "OML" calculations for power plants. This method reckons out the extent of actual air pollutant emission per hour. Another aim was to formulate future principles in this relation. Previous reckonings on the spread of air pollutants in the atmosphere have, it is claimed, been based on the supposition that a power plant operates optimally and continuously throughout each 24-hour day, and that the desulphurization equipment is consistently out of function. The new model is recommended by the working group under the conditions that each 24-hr. period is reckoned as an ordinary day without interruptions in operation. Profiles should vary according to the season. Each profile should contain 3 load levels answering to the three levels of tariffs. The operation of the desulphurization system is simulated realistically, and in detail. It is also recommended that the Danish authorities should monitor the calculation procedure and that these conditions are adhered to. Measured emissions must be compared to assumed (allowed) emissions and, if the former exceeds the latter, the allowed amount of emissions should be re-evaluated by the power plants and the authorities in cooperation. If this evaluation shows that future measured emissions will have a tendency to increase in relation to those allowed, steps (such as re-dimensioning of chimneys or the future use of coal with a low sulphur content) will have to be taken in order to improve the situation. (AB).

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 17827, 18225, 18277

18284 (DOE/EIS–0131-Vol.3-Final) **Initial Northwest Power Act power sales contracts: Final environmental impact statement: Volume 3, Appendix M, Contract copies.** USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1992. 299p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012665. Source: OSTI; NTIS; GPO Dep.

This report, is part of the final environmental impact statement of the Bonneville Power Administration, consists of an appendix of contract copies related to the following: Detailed Index to Generic Utility Power Sales Contracts, Text of Generic Utility Contract, Detailed Index to Generic DSI Power Sales Contracts, Text of Generic DSI Contract, Text of Residential Purchase and Sale Agreement (Residential Exchange), and Detailed Index to General Contract Provisions – GCP Form PSC-2 (Incorporated into all three types of contracts as an Exhibit).

18285 (NEI-DK–609) **Electric power production contra electricity savings: Half-way report.** Schleisner, L.; Grohnheit, P.E.; Soerensen, H. Risoe National Lab., Roskilde (Denmark). Systems Analysis. Jan 1991 64p. (In Danish). Order Number DE92506344. Source: OSTI; NTIS (US Sales Only); INIS.

The expansion of electricity-producing plants has, in Denmark until now, taken place in accordance with the demand for electricity. Recently, it has been suggested that the cost of the further development of such systems is greater than the cost of instigating and carrying out energy conservation efforts. The aim of the project was to evaluate the consequences for power producing plants of a reduction of the electricity consumption of end-users. A method for the analysis of the costs involved in the system and operation of power plants contra the costs that are involved in saving electricity is presented. In developing a model of this kind, consideration is given to the interplay of the individual saving project and the existing or future electricity supply. Thus it can be evaluated to what extent it would be advisable to substitute investments in the development of the capacity of the power plants with investments in the reduction of electricity consumption by the end users. This model is described in considerable detail. It will be tested in representative situations and locations throughout the Nordic countries. (AB) 17 refs.

2007 Legislation and Regulations

Refer also to citation(s) 17827

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

18286 (INIS-mf-13183, pp. 42) **Late phase offsite nuclear emergency planning.** De Waal, S.W.P. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. REACTOR ACCIDENTS/emergency plans; NUCLEAR FACILITIES; RADIATION PROTECTION; SOUTH AFRICAN ORGANIZATIONS

18287 (INIS-mf-13193) **General design criteria for nuclear power facilities.** Bezpecnost Jadernych zarizeni. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1991 17p. Translation of US NRC publication 10 CFR Ch.I(1.1.89 Ed.), Pt.50, App. A. International Atomic Agency, Vienna 1989. (In Czech). Order Number DE92628191. Source: OSTI; NTIS (US Sales Only); INIS.

The general design criteria give the minimal requirements placed on the basic design approach to water-type nuclear power facilities. The criteria are designed to be generally applicable to other types of nuclear power plants as well, and should also serve as guidelines in the development of basic design criteria for other units of similar kind. The development of the criteria has not yet been concluded. The basic requirements concern the quality, design, fire protection, reactor protection, measurement and control systems, containment, media systems testing, radioactivity leak monitoring, spent fuel manipulation, and radiation protection. (M.D.).

18288 (JAERI-M-92-012) **Proceedings of the third CSNI workshop on iodine chemistry in reactor safety.** Ishigure, Kenkichi (Tokyo Univ. (Japan)); Saeki, Masakatsu; Soda, Kunihisa; Sugimoto, Jun (eds.). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1992. 532p. (CONF-9109373-: 3. CSNI workshop on iodine chemistry in reactor safety, Tokai (Japan), 11-13 Sep 1991). Order Number DE92514925. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the collection of the papers presented at the CSNI (Committee on the Safety of Nuclear Installations) workshop on iodine chemistry in reactor safety. The 31 of the presented papers are indexed individually. (J.P.N.).

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 18044, 18058, 18352, 18378, 18391, 18419, 18429, 18435, 18436, 18437, 18439, 18440, 18441, 18442, 18443, 18444, 18446, 18447, 18448, 18449, 18451, 18452, 18453, 18454, 18456, 18458, 18460, 18461, 18462, 18464, 18465, 18466, 18467, 18468, 18469, 18470, 18471, 18473, 18474, 18475, 18476, 18477, 18478, 18479, 18480, 18481, 18482, 18483, 18484, 18485, 18486, 18487, 18488, 18490, 18491, 18492, 18493, 18495, 18496, 18497, 18498, 18502, 18503, 18505, 18506, 18507, 18508, 18509, 18513, 18514, 18515, 18516, 18518, 18519, 18520, 18521, 18522, 18523, 18524, 18525, 18526, 18527, 18528, 18529, 18530, 18531, 18532, 18533, 18537, 18538, 18539, 18540, 18541, 18546, 18563

18289 (ANL/CP-73465) **Thermal aging of cast stainless steels in LWR systems: Estimation of mechanical properties.** Chopra, O.K. Argonne National Lab., IL (United States). Nov 1991. 21p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920631-28: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92012654. Source: OSTI; NTIS; INIS; GPO Dep.

A procedure and correlations are presented for predicting Charpy-impact energy, tensile flow stress, fracture toughness J-R curve, and J_{IC} of aged cast stainless steels from known material information. The "saturation" impact strength and fracture toughness of a specific cast stainless steel, i.e., the minimum value that would be achieved for the material after long-term service, is estimated from the chemical composition of the steel. Mechanical properties as a function of time and temperature of reactor service are estimated from impact energy and flow stress of the unaged material and the kinetics of embrittlement, which are also determined from chemical composition. The J_{IC} values are determined from the estimated J-R curve and flow stress. Examples of estimating mechanical properties of cast stainless steel components during reactor service are presented. A common "lower-bound" J-R curve for cast stainless steels of unknown chemical composition is also defined for a given grade of steel, ferrite content, and temperature.

18290 (CONF-9204105-7) **Coupled thermohydraulic-neutronic instabilities in boiling water nuclear reactors: A review of the state of the art.** March-Leuba, J. (Oak Ridge National Lab., TN (United States)); Rey, J.M. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. Organization for Economic Cooperation and Development (OECD)/Committee on the Safety of Nuclear Installations (CSNI) specialists meeting; Karlsruhe (Germany); 1-3 Apr 1992. Order Number DE92010990. Source: OSTI; NTIS; INIS; GPO Dep.

This paper provides a review of the current state of the art on the topic of coupled neutronic-thermohydraulic instabilities in boiling water nuclear reactors (BWRs). The topic of BWR instabilities is of great current relevance since it affects the operation of a large number of commercial nuclear reactors. The recent trends towards introduction of high efficiency fuels that permit reactor operation at higher power densities with increased void reactivity feedback and decreased response times, has resulted in a decrease of the stability margin in the low-flow, high-power region of the operating map. This trend has resulted in a number of "unexpected" instability events. For instance, United States plants have experienced two instability events recently, one of them resulted in an automatic reactor scram; in Spain, two BWR plants have experienced unstable limit cycle oscillations that required operator action to suppress. Similar events have been experienced in other European countries. In recent years, BWR instabilities have been one of the more exciting topics of work in the area of transient thermohydraulics. As a result, significant advances in understanding the physics behind these events have occurred, and a "new and improved" state of the art has emerged recently.

18291 (EGG-SSRE-9639) **Component external leakage and rupture frequency estimates.** Eide, S.A.; Khericha, S.T.; Calley, M.B.; Johnson, D.A.; Marteeny, M.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012357. Source: OSTI; NTIS; INIS; GPO Dep.

In order to perform detailed internal flooding risk analyses of nuclear power plants, external leakage and rupture frequencies are needed for various types of components - piping, valves, pumps, flanges, and others. However, there appears to be no up-to-date, comprehensive source for such frequency estimates. This report attempts to fill that void. Based on a comprehensive search of Licensee Event Reports (LERs) contained in Nuclear Power Experience (NPE), and estimates of component populations and exposure times, component external leakage and rupture frequencies were generated. The remainder of this report covers the specifies of the NPE search for external leakage and rupture events, analysis of the data, a comparison with frequency estimates from other sources, and a discussion of the results.

18292 (VTT-TIED–1232) **TRAB - A transient analysis program for BWR. Part 2: User's manual.** Raety, H. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Rajamaeki, M. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1991. 153p. Order Number DE92628193. Source: OSTI; NTIS (US Sales Only); INIS.

TRAB is a transient analysis code for BWRs developed at the Technical Research Centre of Finland. It models the phenomena in the interior of the BWR pressure vessel and in related subsystems. The core model of TRAB can be used separately for LWR modelling. For PWR modelling the core model of TRAB is connected to circuit model SMABRE to form the SMATRA code. This report is a user's manual and documents the structure, contents and preparation of input for TRAB. The structure of TRAB input is very flexible, featuring input groups and subgroups identified with keywords and given in any order as well as data items in free format, freely mixed with explanatory texts. Users interface of the code can be used for modelling within input: through normal input it is possible to create new submodels. These may be functional or tabulated dependencies of the code variables, different types of delays, or ordinary linear differential equations.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 18035, 18044, 18058, 18289, 18291, 18352, 18382, 18383, 18384, 18391, 18412, 18414, 18419, 18420, 18425, 18426, 18429, 18430, 18436, 18437, 18438, 18439, 18440, 18441, 18442, 18443, 18445, 18447, 18448, 18449, 18450, 18451, 18452, 18453, 18454, 18455, 18456, 18457, 18458, 18459, 18460, 18461, 18462, 18463, 18464, 18465, 18466, 18467, 18468, 18469, 18470, 18471, 18472, 18473, 18474, 18475, 18477, 18478, 18479, 18480, 18481, 18482, 18483, 18484, 18485, 18486, 18487, 18488, 18489, 18492, 18493, 18494, 18495, 18496, 18497, 18499, 18500, 18501, 18502, 18504, 18505, 18506, 18507, 18508, 18509, 18513, 18514, 18515, 18516, 18517, 18518, 18519, 18520, 18521, 18522, 18523, 18524, 18525, 18526, 18527, 18528, 18529, 18530, 18531, 18532, 18533, 18534, 18535, 18536, 18537, 18538, 18539, 18540, 18541, 18543, 18544, 18545, 18547, 18548, 18549, 18550, 18551, 18552, 18553, 18554, 18555, 18556, 18557, 18558, 18559, 18563, 18838, 18863, 19111

18293 (AEA-RS–1081) **Post-test analysis of LOBI BT-01 using RELAP5/MOD2 and RELAP5/MOD3.** Holmes, B.J. AEA Reactor Services, Winfrith (United Kingdom). Aug 1991. 111p. Contract A036a;A129a. Order Number DE92628196. Source: OSTI; NTIS (US Sales Only); INIS.

Work carried out for Nuclear Electric.

LOBI is a high pressure, electrically heated integral system test facility simulating a KWU 1300 MW PWR scaled 1:712 by volume, although full scale has been maintained in the vertical direction. This report describes the results of an analysis of test BT-01, which simulates a 10% steam line break. The bulk of the analysis was performed using the Project Version of RELAP5/MOD2, with additional calculations using RELAP5/MOD3 for comparison. The codes provided generally good agreement with data. In particular, the break flows were well modelled, although the mass flow data proved to be unreliable, and this conclusion had to be derived from interpreting other signals. RELAP over-predicted primary/secondary heat transfer in the broken loop, however, leading to a more rapid cool-down of the primary circuit. Furthermore, the primary side pressure response was critically dependent upon the pressuriser behaviour, and the correct timing of the uncovery of the surge line. Inter-phase drag was not well predicted in the broken loop steam generator internals, although some improvement was seen in the RELAP5/MOD3 predictions. MOD3 gave a reduction in primary/secondary heat transfer during the test pre-conditioning phase, resulting in a lower secondary side pressure at the start of the transient compared with MOD2. (author).

18294 (CONF-920538–3) **GOOSE Version 1.4: A powerful object-oriented simulation environment for developing reactor models.** Nypaver, D.J. (Oak Ridge National Lab., TN (United States)); March-Leuba, C.; Abdalla, M.A.; Guimaraes, L.; Ford, C.E. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92010122. Source: OSTI; NTIS; INIS; GPO Dep.

A prototype software package for a fully interactive Generalized Object-Oriented Simulation Environment (GOOSE) is being developed at Oak Ridge National Laboratory. Dynamic models are easily constructed and tested; fully interactive capabilities allow the user to alter model parameters and complexity without recompilation. This environment provides assess to powerful tools such as numerical integration packages, graphical displays, and online help. In GOOSE, portability has been achieved by creating the environment in Objective-C[1], which is supported by a variety of platforms including UNIX and DOS. GOOSE Version 1.4 introduces new enhancements like the capability of creating "initial," "dynamic," and "digital" methods. The object-oriented approach to simulation used in GOOSE combines the concept of modularity with the additional features of allowing precompilation, optimization, testing, and validation of individual modules. Once a library of classes has been defined and compiled, models can be built and modified without recompilation. GOOSE Version 1.4 is primarily command-line driven.

18295 (EGG-NE–10046) **Steam generator secondary pH during a steam generator tube rupture.** Adams, J.P.; Peterson, E.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 132p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012219. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Regulatory Commission requires utilizes to determine the response of a pressurized water reactor to a steam generator tube rupture (SGTR) as part of the safety analysis for the plant. The SGTR analysis includes assumptions regarding the partitioning of iodine between liquid and vapor in steam generator secondary. Experimental studies have determined that the partitioning of iodine in water is very sensitive to the pH. Based on this experimental evidence, the NRC requested the INEL to perform an analytical assessment of secondary coolant system (SCS) pH during an SGTR. Design basis thermal and hydraulic calculations were used together with industry standard chemistry guidelines to determine the SCS chemical concentrations during an SGTR. These were used as input to the Facility for Analysis of Chemical Thermodynamics computer system to calculate the equilibrium pH in the SCS at various discrete time during an SGTR. The results of this analysis indicate that the SCS pH decreases from the initial value of 8.8 to approximately 6.5 by the end of the transient, independent of PWR design.

18296 (INIS-mf–13159, pp. 114-119) **A new design of blowdown sampling and of an assembly for heat transfer tube surveillance specimens as a way to extending the lifetime of WWER-440 units.** Matal, O. (Vyzkumny Ustav Energetickych Zarizeni, Brno (Czechoslovakia)); Tomas, Z. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

A total of 16 boiler water sampling probes were installed at two steam generators of unit 4 of the Dukovany nuclear power plant. The blowing-down was modified by means of an internal structure so that it proceeds from areas with the highest concentrations of impurities. An asset of this approach is the feasibility of mounting the structure into operated steam generators. A surveillance specimen programme was developed to detect primary circuit leaks. Heat transfer tube surveillance specimens are approximately 600 mm long, are filled with water or air and pressure sealed at the two ends. The tube specimens are fastened in a special assembly and suspended on a support system in the steam generator. The specimens can be removed at a preselected time during scheduled outage without disturbing the compactness of the tube beam. (M.D.). 2 figs., 5 refs.

18297 (INIS-mf–13159, pp. 138-142) **Calculation of the residual lifetime of components of the main circulation circuits of Czechoslovak WWER-440 type nuclear power plants, based on a histogram of the actual power plant working loads.** Maly, A. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur); Partyk, K. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

A description is given of the theory behind residual lifetime calculations for basic components of the main circulation circuit. Operation parameters, viz. temperature and pressure changes, were measured at the Dukovany nuclear power plant. The computer program produces inputs from archived data and calculates mechanical stresses in selected components of the main circulation circuit and summations of these stresses with non-steady-state temperature stresses. It processes a sequence of voltage extrema by the flowing rain method. The output involves values of fatigue damage of selected components of the main circulation circuit. First experience was gained in 1989. The results will serve as part of the starting data for operation optimization and for the nuclear power plant life extension. (M.D.). 1 fig., 4 refs.

18298 (INIS-mf–13183, pp. 41) **Calculation of the gamma flux of a PWR 175 cm from the centre of the core.** De Klerk, P. (Electricity Supply Commission, Johannesburg (South Africa)); Ross-Jones, B. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. PWR TYPE REACTORS/gamma radiation; PWR TYPE REACTORS/radiation flux; COMPUTER CALCULATIONS; CROSS SECTIONS; GAMMA SPECTRA; GEOMETRY; ISOTOPE SEPARATION; NEUTRON FLUX; REACTOR CORES; S CODES; SHIELDING; URANIUM 235; X CODES

18299 (INIS-mf–13183, pp. 42) **A comparison of the relative effectiveness of three methods of monitoring primary to secondary leakrate utilizing radiological measurement.** Keenan, N.H. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIATION MONITORING/leaks; COMPARATIVE EVALUATIONS; CONTAINMENT BUILDINGS; ENVIRONMENT; FALLOUT; ON-LINE CONTROL SYSTEMS; PRESSURE TUBES; PRIMARY COOLANT CIRCUITS; PWR TYPE REACTORS; LEAKS; STEAM GENERATORS

18300 (INIS-SU–309/A, pp. 3-13) **Experience of the reactor surveillance programme at the Paks NPP.** Trampus, P.; Ronaky, J. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Consideration is given to the main points of the program of observing the behaviour of reactor vessel material during the Paks power plant operation (Hungary). Principle results of observations are summerized briefly. The dependence of destruction process on temperature is determined. It is noted that reactor vessel life time is determined in the main by radiation effects on welded joints. 4 refs.; 6 figs.; 2 tabs.

18301 (JAERI-M–91-220) **Pre-pulse irradiation examination, NSRR pulse irradiation and post-pulse irradiation examination of MH-1 fuel rod.** Yanagisawa, Kazuaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sasajima, Hideo; Katanishi, Shoji. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1992. 192p. Order Number DE92514972. Source: OSTI; NTIS (US Sales Only); INIS.

The Nuclear Safety Research Reactor (NSRR) program for studying failure threshold of pre-irradiated LWR fuel under simulated reactivity initiated accident conditions is in progress. In this program a 14 x 14 PWR type fuel K4-1 was segmented from K4/G08 long size PWR rod pre-irradiated in MIHAMA Unit-2 and was pulse irradiated on November 28, 1989 at NSRR. Energy deposition given to the test rod was 60 cal/g·fuel. No failure indication was observed by in-core monitoring and by post-pulse irradiation examination. As one of the NSRR data base on fuel behavior during transient/RIA, data obtained from pre-pulse irradiation examination, during NSRR pulse irradiation, and from post-pulse irradiation examination are summarized. (author).

18302 (KIYal–90-32) **Determination of the influence of heat carrier overflowing over the active zone on a value of radiation correction into the measurements of heat carrier temperature at the outlet from the heat-releasing assemblies of WWER-440 reactors.** Zakharov, A.S.; Pavlenko, V.P.; Slesarevskij, S.O.; Tkachenko, A.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 13p. (In Russian). Order Number DE92626908. Source: OSTI; NTIS (US Sales Only); INIS.

Equation of heat balance at fuel assembly (FA) outlet and at the inlet of hot filaments of circulation loops is used to analyze the influence of overflowing of primary circuit coolant on determination of error, caused by radiation heating of thermocouples, set up at FA outlet. Algorithm for calculating heat of coolant overflowing through FA gaps in WWER-440 reactor core is derived. Qualitative and quantitative analysis of the effect of coolant overflowing on coolant heat content in hot filaments of circulation loops is presented. 5 refs.; 2 figs.; 3 tabs.

18303 (NUREG/IA–0056) **Assessment of subcooled boiling model used in RELAP5/MOD2 (Cycle 36.05, Version E03) against experimental data: International agreement report.** Brain, C.R. (Central Electricity Generating Board, Barnwood (United Kingdom). Generation Development and Construction Div.). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Central Electricity Generating Board, Barnwood (United Kingdom). Generation Development and Construction Div. Mar 1992. 27p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (GD/PE-N–729). Source: OSTI; NTIS; INIS; GPO.

In order to test the ability of RELAP5/MOD2 to describe sub-cooled nucleate boiling under conditions similar to those anticipated during intact circuit fault scenarios in pressurized water reactors the code has been assessed against results of high pressure sub-cooled boiling experiments reported in literature. It is concluded that RELAP5/MOD2 can be applied with reasonable confidence to the prediction of sub-cooled boiling void fraction for conditions expected during PWR intact circuit faults.

18304 (OEFZS–4602) **Security aspects of Czechoslovakian nuclear power plants.** Mueck, K. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Nov 1991. 20p. (In German). Order Number DE92626909. Source: OSTI; NTIS (US Sales Only); INIS.

The nuclear power plants in operation or under construction in the CSFR which basically represent the pressure water type reactor of soviet design VVER-440 and VVER-1000, are briefly described. In particular, their safety aspects and possible safety defficiencies are discussed. The first generation VVER-440/230 possesses, apart from some positive safety features, severe safety defficiencies which may be only improved by substantial reconstructions, whereas with the second generation VVER-440/213 substantial improvements in these safety defficiences may be noticed. The third generation VVER-1000 largely corresponds to

Western safety standards. With the second generation VVER-440/213 further safety research is required to better estimate the behaviour of the reactor under severe accident conditions, in particular, with regard to potential activity releases. (author).

18305 (PEL–299) **Summary description of the RELAP5 Koeberg-1 simulation model.** D'Arcy, A.J. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Nov 1990. 178p. Order Number DE92626910. Source: OSTI; NTIS (US Sales Only); INIS.

The main features of the RELAP5 code and the model are summarized. The model has been quality-assured in accordance with a QA programme used in the Reactor Theory Group of the Atomic Energy Corporation of SA Ltd. The RELAP5 code is based on a non-homogeneous, non-equilibrium model for the two-phase system that is solved by a fast, partially implicit numerical scheme. The objective of the development effort from the outset has been to produce a code that includes important first-order effects necessary for accurate prediction of system transients, but is sufficiently simple and cost-effective so that parametric or sensitivity studies are possible. The code includes many generic component models from which general systems can be simulated. Special process models are included for effects such as form losses, flow at an abrupt area change, branching, choked flow, boron tracking and a non-condensible gas. The RELAP5 modelling and computational aspects covered are: hydrodynamic models, constitutive package, special process models, and user conveniences. 25 tabs., 8 figs., 17 refs.

18306 (PEL–304) **LINX-1: a code for linking polynomial cross section files.** Ras, H. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jul 1991. 19p. Order Number DE92626911. Source: OSTI; NTIS (US Sales Only); INIS.

The capabilities of the LINX-1 code are described. It was developed for the purpose of linking seperate fuel assembly and reflector node polynomial cross section files, obtained by the POLX-1 code, together into a single reactor polynomial cross section library. The output of the polynomial cross section library can be in either binary or fixed (BCD) format. Input data requirements and the format of the output file generated by LINX-1 are also described. 2 refs.

18307 (PEL–310) **PREP-PWR-1.0: a WIMS-D/4 preprocessor code for the generation of data for PWR fuel assemblies.** Ball, G. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jun 1991. 45p. Order Number DE92626912. Source: OSTI; NTIS (US Sales Only); INIS.

The PREP-PWR-1.0 computer code is a substantially modified version of the PREWIM code which formed part of the original MARIA System (Report J.E.N. 543). PREP-PWR-1.0 is a comprehensive pre-processor code which generates input data for the WIMS-D/4.1 code (Report PEL 294) for PWR fuel assemblies, with or without control and burnable poison rods. This data is generated at various base and off-base conditions. The overall cross section generation methodology is described, followed by a brief overview of the model. Aspects of the base/off-base calculational scheme are outlined. Additional features of the code are described while the input data format of PREP-PWR-1.0 is listed. The sample problems and suggestions for further improvements to the code are also described. 2 figs., 2 tabs., 12 refs.

18308 (PEL–311) **KOEBLIB1.0: Two group polynomial cross section library for Koeberg version 1.** Ball, G.; Mueller, E.Z.; Ras, H. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jul 1991. 22p. Order Number DE92626913. Source: OSTI; NTIS (US Sales Only); INIS.

The mathematical models and engineering data used for the generation of version 1 of the 2-group polynomial cross section library for the two PWR units at the Koeberg Nuclear Power Station, are described. This library was prepared using the few-group coarse mesh cross section generation package of the Reactor Theory Programme at the Atomic Energy Corporation of South Africa Ltd. An overall description of the calculational scheme as well as descriptions of the various modules used for the generation of the cross section library is given. The fuel assembly model is described in detail and the values of the operational parameters used, are given. The methods used to generate the ex-core reflector data are described. Details of the generation of the polynomial library are given and the assembly and reflector engineering data are listed. 2 figs., 6 tabs., 19 refs.

18309 (Windscale-Trans–1197) **Investigation programme for VVER-440 spent fuel assemblies and its implementation.** Dubrovin, K.P.; Smirnov, V.P.; Smirnov, A.V.; Nikishov, O.A.; Vasil'chenko, I.N.; Dvoretskii, V.G. AEA Technology, Windscale (United Kingdom). [1991]. 23p. Translated from Russian. Paper to Soviet-Finnish seminar, May 1991, Inst. Atmonogo Energii (IAE). Order Number DE92628197. Source: OSTI; NTIS (US Sales Only); INIS.

The paper gives the basic principles of the investigation programme for VVER-440 spent fuel assemblies. The programme provides for the investigation of assemblies whose design, materials of manufacture, method of production and operating conditions have been purposely varied. In the first instance these variations include increasing the burn-up, changing the enrichment, increasing the operating period, etc. The post-irradiation investigations of the VVER-440 assemblies are based on the complex of hot cells at NIIAR (Nauchno-Issledovatel'skii Institut Atmomnykh Reaktorov - Scientific Research Institute for Atomic Reactors), IAE (Institut Atomnoi Energii - Institute of Atomic Energy) and the Novovoronezh nuclear power station. Novovoronezh mainly uses nondestructive methods of investigation, while IAE and NIIAR make wide use of the most varied and up-to-date methods and resources of materials research. The assemblies for investigation are transported in standard TK-6 units, and after investigation they are put into special skips for salvaging. (author).

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 18058, 18427, 18428, 18512, 18938

18310 (CONF-920432–7) **An international assessment of the gas tubine MHTGR.** Penfield, S.R. (Gas-Cooled Reactor Associates, San Diego, CA (United States)); Kerr, H.T.; Schleicher, R.W. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 54. annual American power conference; Chicago, IL (United States); 13-15 Apr 1992. Order Number DE92011687. Source: OSTI; NTIS; INIS; GPO Dep.

The potential for gas turbine applications of the MHTGR has been addressed in a recent evaluation sponsored by the Empire State electric Energy Research Corporation (ESEERCO), the US Department of Energy (DOE), Oak Ridge National Laboratory (ORNL) and Gas-Cooled Reactor Associates (GCRA). Additional support for the evaluation was provided by representatives of the French. German and Japanese nuclear communities. The results of this internationally based gas turbine evaluation are the subject of this paper.

18311 (DOE-HMIP-RR–92.004) **Measurement of radioactivity from Chernobyl in population groups in Scotland - Report 2.** East, B.W.; Robertson, I.; Walker, M.E. Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. 1992. 58p. Contract PECD-7/9/386;HP91/02. Order Number DE92628214. Source: OSTI; NTIS (US Sales Only); INIS.

Previous report: DOE-RW–88.103.

The uptake of radiocaesium by members of the Scottish population following the reactor accident at Chernobyl was measured by whole-body counting between March 1988 and March 1990. 216 measurements of ^{137}Cs and ^{134}Cs were made, 193 of which were repeat measurements on volunteers included in an earlier study. The influence of sex, age, diet and geographical location on ^{137}Cs uptake was re-examined and it was found that: there was no difference between males and females; during part of the study, the levels of ^{137}Cs in children had declined more rapidly than those in adults; only game and venison eaters showed distinctly higher body radiocaesium compared with the rest of the population; and only marginal differences due to geographical location were observable. The decline in body ^{137}Cs in the population showed a half-life of 550 days and the total effective dose equivalent for the population mean was 69μSv, an increase of 12% on the previous estimate. From the observed rate of decrease, the mean value of body ^{137}Cs in the Scottish population will reach the pre-Chernobyl level in 1992. The relationship between body ^{137}Cs and urinary ^{137}Cs output was also studied. Urinary analysis for mass-screening of the population appeared possible, provided micturition intervals could be adequately recorded. (author).

18312 (INIS-mf-13153, pp. 1-14) **Report regarding consequences of catastrophe in Chernobyl.** Dakowski, M. (Centralny Urzad Planowania, Warsaw (Poland)); Downarowicz, M.; Jaracz, P. National Atomic Energy Agency, Warsaw (Poland). Dec 1991. 119p. (In Polish). In *Report regarding consequences of catastrophe in Chernobyl together with enclosures 2 and 4.* Order Number DE92622217. Source: OSTI; NTIS (US Sales Only); INIS.

On 28 April 1986 the people rights as well as the valid law were violated in Poland. The public was informed with a delay about Chernobyl catastrophe. The remedial actions were delayed about 24 hours due to political reasons. The present state of radiation monitoring system in Poland is critized. The catastrophe consequences in environment are presented. The wholesome consequences are assessed. The list of nuclear power plants in neighbouring countries is enclosed. The basic parameters of the plants and their distances from Polish borders are given. (A.S.).

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 18361, 18385, 18485, 18510, 18572

18313 (AECL-9331) **Modelling CANDU fuel under normal operating conditions: ELESTRES code description.** Tayal, M. Atomic Energy of Canada Ltd., Sheridan Park, ON (Canada). CANDU Operations. Feb 1987. 30p. (CANDEV-86-110.). Order Number DE92626944. Source: OSTI; NTIS (US Sales Only); INIS.

In nuclear fuel elements, sheaths provide a barrier against release of radioactive fission products to the surrounding coolant. Hence the integrity of the sheath and of the sheath/endcap weld, is an important consideration in the design of fuel elements. The finite element code ELESTRES models the two-dimensional axisymmetric behaviour of a CANDU fuel element during normal operating conditions such as steady power, power changes, and load following. The main focus of the code is to estimate temperatures, fission gas release, and axial variations of deformations/stresses in the pellet and in the sheath. Thus the code models details like stresses/strains at circumferential ridges. This report describes the major features of an improved version of ELESTRES. Predictions of ELESTRES show good agreement with about 80 measurements of fission gas release. In this report, we also present ELESTRES predictions of hoop strains in sheaths, for two irradiations. For both irradiations, predictions compare favourably with measurements. An illustrative example shows that near circumferential ridges, bending contributes to multiaxial stresses in the sheath. This can have a significant effect on sheath integrity, such as during stress corrosion cracking due to power increases, or during corrosion-assisted-fatigue due to power-cycling.

18314 (AECL-9333) **BOW. A computer code to predict lateral deflections of composite beams: A computer code to predict lateral deflections of composite beams.** Tayal, M. Atomic Energy of Canada Ltd., Sheridan Park, ON (Canada). CANDU Operations. Aug 1987. 16p. (CONF-870812-: 9. biennial international conference on structural mechanics in reactor technology (SMIRT-9), Lausanne (Switzerland), 17-21 Aug 1987). Order Number DE92628219. Source: OSTI; NTIS (US Sales Only); INIS.

Arrays of tubes are used in many engineered structures, such as in nuclear fuel bundles and in steam generators. The tubes can bend (bow) due to in-service temperatures and loads. Assessments of bowing of nuclear fuel elements can help demonstrate the integrity of fuel and of surrounding components, as a function of operating conditions such as channel power. The BOW code calculates the bending of composite beams such as fuel elements, due to gradients of temperature and due to hydraulic forces. The deflections and rotations are calculated in both lateral directions, for given conditions of temperatures. Wet and dry operation of the sheath can be simulated. Bow accounts for the following physical phenomena: circumferential and axial variations in the temperatures of the sheath and of the pellet; cracking of pellets; grip and slip between the pellets and the sheath; hydraulic drag; restraints from endplates, from neighbouring elements, and from the pressure-tube; gravity; concentric or eccentric welds between endcap and endplate; neutron flux gradients; and variations of material properties with temperature. The code is based on fundamental principles of mechanics. The governing equations are solved numerically using the finite element method. Several comparisons with closed-form equations show that the solutions of BOW are accurate. BOW's predictions for initial in-reactor bow are also consistent with two post-irradiation measurements.

18315 (AECL-10325) **Mitigation of degradation mechanisms affecting CANDU pressure tubes.** Simpson, L.A. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment); Coleman, C.E. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Dec 1990. 25p. (CONF-9010488-: 16. MPA-seminar, Pinawa (Canada), 4-5 Oct 1990). Order Number DE92626943. Source: OSTI; NTIS (US Sales Only); INIS.

The Zr-2.5% Nb alloy pressure tube provides the primary containment for coolant in the CANDU reactor. Because these tubes contain the individual fuel strings and pass neutron flux of up to 4.0 x 10^{17} neutrons per square meter per second ($E > 1$ MeV). Any demonstration of the integrity of these tubes relies on a leak-before-break (LBB) assessment, which, in turn, depends on the fracture properties of the tube. These properties become degraded with service due to both the gradual pickup of hydrogen isotopes and the reduction of fracture toughness due to irradiation. This paper gives an overview of the relevant fracture properties used in the LBB scenario and the effect of service conditions on their degradation. The particular properties discussed are the susceptability to subcritical crack growth by delayed hydride cracking, and the reduction in fracture toughness which reduces the critical crack length. Methods of protecting the tubes against fracture and improving their properties are discussed.

18316 (AECL-10339) **Prospects for stronger calandria tubes.** Ells, C.E.; Coleman, C.E.; Hosbons, R.R.; Ibrahim, E.F.; Doubt, G.L. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Dec 1990. 13p. (CONF-900621-: 30. annual conference of the Canadian Nuclear Association and the 11th annual conference of the Canadian Nuclear Society, Toronto (Canada), 3-7 Jun 1990). Order Number DE92628216. Source: OSTI; NTIS (US Sales Only); INIS.

The CANDU calandria tubes, made of seam welded and annealed Zircaloy-2, have given exemplary service in-reactor. Although not designed as a system pressure containment, calandria tubes may remain intact even in the face of pressure tube rupture. One such incident at Pickering Unit 2 demonstrated the economic advantage of such an outcome, and a case can be made for increasing the probability that other calandria tubes would perform in a similar fashion. Various methods of obtaining stronger calandria tubes are available, and reviewed here. When the tubes are internally pressurized, the weld is the weak section of the tube. Increasing the oxygen concentration in the starting sheet, and thickening the weld, are promising routes to a stronger tube.

18317 (AECL-10464) **An in-reactor loss-of-coolant test with flow blockage and rewet.** MacDonald, R.D. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); DeVaal, J.W.; Cox, D.S.; Dickson, L.W.; Jonckheere, M.G.; Ferris, C.E.; Keller, N.A.; Wadsworth, S.L. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Oct 1991. 16p. (CONF-910714-: International topical meeting on safety of thermal reactors, Portland, OR (United States), 21-25 Jul 1991). Order Number DE92628217. Source: OSTI; NTIS (US Sales Only); INIS.

Three CANDU-type fuel elements were subjected to a blowdown transient in the Blowdown Test Facility of the NRU reactor. These elements, operating at 41 to 43 kW/m, went into sustained dryout about 22 seconds after depressurization. Sheath temperatures escalated rapidly following dryout, and subsequent damage to the elements caused a flow blockage below the fuel assembly. The high-temperature transient was terminated by automatic reactor shutdown and the initiation of cold water rewet. The first rewet water vapourized, but rewet eventually cooled the fuel. Fission products were released and measured during and following the transient. Post-irradiation examination has shown severe fuel damage at the bottom of the assembly.

18318 (AECL–10508) **Technology alliances: The CANDU model.** Torgerson, D.F. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Boczar, P.G.; Kugler, G. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Oct 1991. 10p. (CONF-9110364–: 10. annual joint meeting of the Canada-Korea business council, Montreal (Canada), 21 Oct 1991). Order Number DE92628218. Source: OSTI; NTIS (US Sales Only); INIS.

In the field of nuclear technology, Canada and Korea developed a highly successful relationship that could serve as a model for other high-technology industries. This is particularly significant when one considers the complexity and technical depth required to design, build and operate a nuclear reactor. This paper will outline the overall framework for technology transfer and cooperation between Canada and Korea, and will focus on cooperation in nuclear R and D between the two countries.

18319 (BNL–47331) **Electrically-induced stresses and deflection in multiple plates.** Hu, Jih-Perng; Tichler, P.R. Brookhaven National Lab., Upton, NY (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9205145–1: 11. symposium on engineering applications of mechanics, Saskatchewan (Canada), 11 May 1992). Order Number DE92012303. Source: OSTI; NTIS; INIS; GPO Dep.

Thermohydraulic tests are being planned at the High Flux Beam Reactor of Brookhaven National Laboratory, in which direct electrical heating of metal plates will simulate decay heating in parallel plate-type fuel elements. The required currents are high if plates are made of metal with a low electrical resistance, such as aluminum. These high currents will induce either attractive or repulsive forces between adjacent current-carrying plates. Such forces, if strong enough, will cause the plates to deflect and so change the geometry of the coolant channel between the plates. Since this is undesirable, an analysis has been made to evaluate the magnitude of the deflection and related stresses. In contrast to earlier publications in which either a concentrated or a uniform load was assumed, in this paper an exact force distribution on the plate is analytically solved and then used for stress and deflection calculations, assuming each plate to be a simply supported beam. Results indicate that due to superposition of the induced forces between plates in a multiple-and-parallel plate array, the maximum deflection and bending stress occur at the midpoint of the outermost plate. The maximum shear stress, which is inversely proportional to plate thickness, occurs at both ends of the outermost plate.

18320 (INFO–0209) **Analysis of data obtained in two-phase flow tests of primary heat transport pumps.** Currie, T.C. (Carleton Univ., Ottawa, ON (Canada)). Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1986. 153p. Order Number DE92626945. Source: OSTI; NTIS (US Sales Only); INIS.

This report analyzes data obtained in two-phase flow tests of primary heat transport pumps performed during the period 1980-1983. Phenomena which have been known to cause pump-induced flow oscillations in pressurized piping systems under two-phase conditions are reviewed and the data analyzed to determine whether any of the identified phenomena could have been responsible for the instabilities observed in those tests. Tentative explanations for the most severe instabilities are given based on those analyses. It is shown that suction pipe geometry probably plays an important role in promoting instabilities, so additional experiments to investigate the effect of suction pipe geometry on the stability of flow in a closed pipe loop under two-phase conditions are recommended.

18321 (INIS-mf–13186) **Wolsung-1 nuclear power plant: Update report, 1983 June.** Kempe, A.J.; Lindsay, R.I. Atomic Energy of Canada Ltd., Sheridan Park, ON (Canada). CANDU Operations. 1983 7p. Order Number DE92628220. Source: OSTI; NTIS (US Sales Only); INIS.

The Wolsung-1 CANDU 600 MWe plant is now in operation. This paper provides an update on the design, construction and commissioning progress reported at last year's conference. The accomplishments of the past year are highlighted with emphasis on how the station has been commissioned in preparation for commercial service and on the skills that were dedicated to the completion of the project. The paper also deals with some of the features of the CANDU 600 MWe Nuclear Power Plant that make it viable for export.

2105 Power Reactors, Breeding

Refer also to citation(s) 17897, 18369, 18371, 18372, 18373, 18374, 18375, 18376, 18377, 18409, 18511, 18566, 18871

18322 (ANL/CP–75357) **Comparison of seismic response of ordinary and base-isolated structures.** Kuroda, T. (Shimizu Corp., Tokyo (Japan)); Kobatake, M.; Seidensticker, R.W.; Chang, Y.W. Argonne National Lab., IL (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920432–6: 54. annual American power conference, Chicago, IL (United States), 13-15 Apr 1992). Order Number DE92010901. Source: OSTI; NTIS; INIS; GPO Dep.

Seismic isolation is growing rapidly worldwide as a cost-effective and reliable design strategy for a wide range of critical and important facilities (e.g., hospitals, computer centers, etc.) Shimizu Corporation of Japan has a test facility at Tohoku University in Sendai, Japan. The test facility was constructed in 1986 and has two buildings: one is base isolated and the other is conventionally founded. The buildings are full-size, three-story reinforced concrete structures. The dimensions and construction of the superstructures are identical. For the past several years, Shimizu Corporation has installed a number of different isolation systems in the isolated building at the test facility to study the response of base isolation systems to actual earthquake motions. Argonne National Laboratory (ANL) has been deeply involved in the development of seismic isolation for use in nuclear facilities for the past decade. Using the funding and direction of the US Department of Energy (USDOE), ANL has been developing methodology needed to evaluate the usefulness and effectiveness of seismic isolation for advanced liquid metal-cooled reactors (LMRs). This paper compares the seismic responses of ordinary and base-isolated buildings. Earthquake records of significant importance from April 1989 to September 1991, after the installation of bearings have been analyzed. Numerical simulations of the building responses have been performed and correlated with earthquake observation data. It is hoped that the results of this study will provide guidelines for the future use of isolator bearings for mitigation of earthquake damages.

18323 (ANL/CP–75478) **Hydrodynamic pressure in a tank containing two liquids.** Tang, Yu. Argonne National Lab., IL (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920631–22: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92013040. Source: OSTI; NTIS; INIS; GPO Dep.

A study on the dynamic response of a tank containing two different liquids under seismic excitation is presented. Both analytical and numerical (FEM) methods are employed in the analysis. The results obtained by the two methods are in good agreement. The response functions examined include the hydrodynamic pressure, base shear and base moments. A simple approach that can be used to estimate the fundamental natural frequency of the tank-liquid system containing two liquids is proposed. This simple approach is an extension of the method used for estimating the frequency of a tank-liquid system containing only one liquid. This study shows that the dynamic response of a tank filled with two liquids is quite different from that of an identical tank filled with only one liquid.

18324 (CONF-920538–7) **MPP: A modular library of models of nuclear reactor components.** Abdalla, M.A. (Tennessee Univ., Knoxville, TN (United States)); Guimaraes, L.; Ugolini, D.; March-Leuba, C.; Nypaver, D.J.; Ford, C.E. Oak Ridge National Lab., TN

(United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92011142. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the Modular Power Plant (MPP) library and its application to simulate the Advanced Liquid Metal Reactor. The MPP library is being developed as part of the Advanced Controls Program of the Oak Ridge National Laboratory. The general purpose of the library is to provide a set of modular models of components needed to simulate nuclear power plants. To give the MPP models modularity characteristics, each model is developed as a stand-alone system. The MPP contains 28 models coded in either the Advanced Continuous Simulation Language (ACSL), or the Generalized Object-Oriented Simulation Environment (GOOSE). The MPP development is parallel to the GOOSE development, and we are currently translating the MPP components from ACSL to GOOSE.

18325 (KFK–4935, pp. 17-27) **Influence of sodium exposure on creep rupture strength of type 304 and 316 steels.** Wada, Y. (Power Reactor and Nuclear Fuel Development Corp., Ibaraki (Japan)); Yoshida, E.; Aoki, M.; Kato, S.; Ito, T. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

Creep rupture tests in sodium for one heat of as-received Type 304 steel hot rolled plate were carried out at 500, 550, 600 and 650C in carburizing atmosphere using cylindrical specimens of 6mm diameter. Creep rupture strength in sodium was almost same as that in air, though tertiary creep embrittlement was observed. Creep rupture tests in air on another heat of Type 304 steel preexposed for 20,000 hrs at 500, 550 and 600 C to carburizing sodium were also examined using same type specimens to compare the sodium-exposure effect under stress loading with that under no loading. Creep rupture strength on the preexposed material was not different from that of the as-received one. Tertiary creep embrittlement was also observed in this test. On-set times of tertiary creep and steady creep rates of both tests; in-sodium and post sodium-exposure tests, were almost same as those of in-air tests for as-received materials. it was supposed that tertiary creep embrittlement should be caused by carburization. Grain boundaries with coagulation of precipitated carbides might crack by large distortion of grains in tertiary creep stage. Tertiary creep embrittlement is related to behavior of grain boundaries near the surface of metal exposed to sodium. Creep rupture tests in sodium for one heat of as-received Type 316 steel hot rolled plate were carried out at 550 C using thin plate specimens of 3mm thickness. As the results tertiary creep embrittlement was not observed and creep rupture strength in sodium was slightly longer than that in air. It was presumed that grain boundaries of Type 316 steel were more ductile than those of Type 304 steel under carburizing sodium environment. Grain boundaries of low carbon (about 0.01%) and nitrogen controlled (0.06-0.10%) modified Type 316 steel, which is similar to European type 316L(N), were more stable than those of Type 316 steel.

18326 (KFK–4935, pp. 28-36) **The effect of decarburization and carburization in sodium on the mechanical properties of austenitic and ferritic steels.** Trapeznikov, Ju.M. (Central Research Inst. of Structural Materials, Prometey (USSR)); Trojanov, V.M. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The dependence of the degree and depth of ferritic steel decarburization and austenitic steel carburization in sodium at various temperatures is considered. The calculation of changed layer depths versus time at operating temperatures is given. The mechanical properties and their dependence on carbon content were studied on various types of austenitic and ferritic steels. The decrease of ferritic steels yield stress and creep rupture, and the decrease of austenitic steels ductility is shown. These changes should be taken into consideration for the evaluation of service life of heat exchanger components contacting with sodium.

18327 (KFK–4935, pp. 37-45) **Materials for fast sodium cooled reactors.** Trapeznikov, Ju.M. (Central Research Inst. of Structural Materials, Prometey (USSR)); Grishmanovskaja, R.N.; Groynin, I.V.; Trojanov, V.M.; Malygin, A.F. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

This paper describes the problems of materials production and application for nuclear power stations with fast reactors. The results of steels selection for reactor equipment and steels operation characteristics are given. The main criteria for the evaluation of reactor, heat exchanger, steam generator case materials service life are discussed. The resulting characteristics of selected materials service life at various temperatures, under cyclic and thermal loading, corrosion behavior in sodium with different carbon and oxygen content are considered. The materials investigation after some hold periods in BN-600, BOR-60 and BN-350 plants show that the selected materials may reliably operate during the prescribed lifetime. The main problems concerning materials selection are put forward.

18328 (KFK–4935, pp. 46-51) **Design data for stainless and high chromium steels in sodium environment.** Escaravage, M.; Ward, M.; Dietz, M.; Capurro, M. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The recommended design data to be used for the European Fast Reactor (EFR) project is one of the tasks of the Design and Construction Rule Committee (DCRC), formed within EFR Associates, the design company associated with the EFR project. This Committee has reviewed the data on mechanical properties in sodium provided by the AGT9A which is the common Research and Development Working Group on material properties for EFR and which is working in particular on sodium environment effects. The DCRC has issued recommendations for the cases where data based on tests in air can be used: thick wall components ($\geq$ 2 mm) in 316L (N) stainless steel, thick wall components in modified 9Cr1Mo steel if a behavior similar to that of the standard 9Cr1Mo is confirmed. The DCRC has still to produce recommendations for thin wall components in 316L (N) steel and the case of modified 9Cr1Mo tubes of the steam generator bundles (extra thickness covering sodium and water side corrosion).

18329 (KFK–4935, pp. 52-69) **Corrosion - Mechanical properties of structural materials in sodium.** Ryzhkov, A.N. (Inst. of Physics and Power Engineering, Obninsk (USSR)); Kononyuk, M.Kh.; Zhelnin, V.D.; Liforov, G.V. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The paper presents the results of research into long-term strength, creep and low cycle fatigue properties of steam generator steels in pure sodium and with sodium hydroxide admixture at 500 and 550 C. The highest sensitivity to alkali effect is manifested by steel 10X18H9. The presence of 5% hydroxide in sodium at 500 C results in the 5% reduction of the long-term strength as compared to pure sodium tests, 45% rise in creep rate. The most appreciable effect of sodium hydroxide is on low-cycle fatigue strength of this steel. When testing in pure sodium and in sodium with 5% hydroxide, with the strain amplitude 0.2% the difference in the number of cycles prior to failure is 2,438 × 10^2 cycles.

18330 (KFK–4935, pp. 70-85) **Salient features and a few results from the sodium loops designed at Indira Gandhi Centre for Atomic Research for metallurgical investigations.** Venugopal, S. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Khatak, H.S.; Gopal, S.; Mishra, M.P.; Mannan, S.L.; Gnanamoorthy, J.B. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

Sodium loops have been designed and built at Indira Gandhi Centre for Atomic Research, Kalpakkam, for metallurgical investigations. The design features and the details of the various components of the loops are discussed in this paper. The results of in-sodium tests carried out on austenitic stainless steels are also discussed.

18331 (KFK–4935, pp. 86-101) **The influence of decarburizing sodium on the creep-rupture behaviour of type 304 stainless steel.** Borgstedt, H.U. (Kernforschungszentrum Karlsruhe GmbH (West Germany)); Frees, G.; Huthmann, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The influence of flowing liquid sodium at 550C on the creep-rupture behavior of the structural material of the SNR 300 reactor, X6CrNi18 11 (DIN 1.4948, equivalent to Type 304 stainless steel) was studied in two non-isothermal sodium loops. It was shown that the effects of sodium are dependent on the carbon activity of the sodium. Under normal (non-decarburizing) sodium conditions a limited reduction of times-to-rupture occurs. This reduction is due to a reduced ductility within the tertiary creep range. The minimum creep rate and the onset of tertiary creep are not influenced. Under decarburizing conditions which are not expected to occur in the sodium of liquid metal fast breeder reactors, an additional loss of creep strength was observed. The steel showed higher creep rates and an earlier onset of tertiary creep. This additional effect seems to be caused by sodium corrosion of surface near layers reducing the unaffected cross section. It depends on the surface-to-volume ratio, and it was nearly suppressed, when specimens with larger diameter were used.

18332 (KFK–4935, pp. 102-119) **The influence of flowing sodium on the creep-rupture behavior of type 316L(N) stainless steel.** Huthmann, H. (Interatom, Bergisch Gladbach (West Germany)); Borgstedt, H.U.; Horton, C.A.P.; Wood, D.S.; Debergh, Ph. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

In liquid sodium some leaching of austenite stabilizing elements and the exchange of nonmetallic elements like carbon and nitrogen may occur and cause changes in the long-term mechanical properties of structural material. To determine the influence of sodium on the creep rupture properties of 316L(N) steel, which will be used in the European Fast Reactor (EFR), two heats of this material have been tested in five different sodium loops at 550 C. In total 42 uniaxial creep rupture tests in sodium with running times up to 27.00 h and 36 parallel tests in air are available. In addition to the as-received condition one heat has been tested in a pre-sensitized (600 C, 1,000 h) condition. For the as-received condition no significant effect of sodium was found and it can be concluded that the design of components starting operation in as-received condition in high purity sodium can be based on in-air data of stress rupture strength, stress rupture ductility (elongation and reduction of area), conditions for onset of tertiary creep, and minimum creep rate. Provisional reservations should be made in recommendations for sensitized material, because for the pre-sensitized material the times to rupture and onset of tertiary creep are somewhat shorter in sodium than in air. The measurements performed on 4 mm diameter specimens of the pre-sensitized material indicate a reduction in strength of about 10%. Metallographic post-test examinations on these specimens will lead to final recommendations.

18333 (KFK–4935, pp. 120-128) **The behavior of notched weldments in liquid sodium under creep stress.** Borgstedt, H.U. (Inst. for Material Research III, Karlsruhe (West Germany)); Frees, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The influence of flowing sodium of 550C on the creep-rupture behavior of welded specimens of the austenitic steel AISI 304 (X6 CrNi 18 11) containing a sharp ellipsoidal precrack rectangular to the gage length in the welded zone is studied in a sodium loop applying stresses in the range of 140 to 200 MPa. The lifetimes of the specimens tested in both media, air and sodium, can be related to the residual stresses in the plane of the precrack. The sodium of high purity reduces the time-to-rupture of the welded specimens containing a precrack. Strain and fracture are concentrated in the notched weldment. The fracture mode is related to the orientation of the welded layers. However, the loss of rupture strength (related to the residual stress) is smaller than in preceding in-sodium creep-rupture tests with base material of the same steel, however, from a different batch and in sodium of a lesser degree of purity. A possible mechanism of the influence of sodium and its corrosive action on the crack formation during the creep deformation is discussed. This research is directly related to the structural materials of the SNR 300 reactor.

18334 (KFK–4935, pp. 129-137) **Stress corrosion of type 304 stainless steel in molten NaOH/Na mixtures.** Menken, G. (Interatom, Bergisch Gladbach (West Germany)); Dietz, W. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

NaOH may be formed under special conditions on components during the ingress of water vapor in a sodium system in the cover gas region. Experiments were performed in order to quantify the corrosion effects, which were produced in stressed samples due to the reaction with a limited amount of dry NaOH on the surface during the exposure under sodium vapor conditions in the temperature range between 350C and 560C. The experiments showed that the amount of NaOH and the duration of exposure was important for the corrosion effects. The highest effects were found, when the H_2/H_2O containing gas reacts near the sodium level at low temperatures above the melting point of NaOH (ca 320C), i.e. when a consumption of NaOH either by evaporation or by the reaction with the metal was negligible. If there exist a sodium vapor pressure in equilibrium at 450C, NaOH surface films are not stable in the presence of 50 vpm H_2O and corrosion reactions are limited. At much higher temperatures of 560C any NaOH films are removed either by evaporation or by a surface reaction and even at 50 vpm H_2O the formation of new NaOH was not possible if sodium at 560C was available.

18335 (KFK–4935, pp. 138-148) **Tensile tests of low-alloy steel 15Mo3 in sodium.** Borgstedt, H.U. (Kernforschungszentrum Karlsruhe GmbH, (West Germany)); Peric, Z. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The low-alloy steel 15Mo3 is applied for peripherically situated components of fast reactors which are operated under low temperature and flow conditions. In the German fast reactor, SNR 300, the sodium drain tanks are fabricated of this material. The fuel element storage tank of the SUPER PHENIX in France was also made of this steel. After the filling of these drain tanks with sodium, cracks occurred at weldments, though the temperature was not higher than 150 C and the stress on the material was not higher than the yield point. The cracks developed without a significant deformation of the component in their neighborhood. Tensile tests of welded and rusted samples of the steel 15Mo3 were performed in liquid sodium at 110, 140, 200 and 300 C in order to get information on the mechanisms of the crack formation under these conditions. All specimens failed in a ductile manner, the tensile curves in air and in Na were nearly identical. The possibility of a liquid metal embrittlement can be excluded from the test results. The reaction of wet rust with sodium could not be introduced into the test procedure. A new set-up is prepared in which such reactions may be superimposed to the tensile stress. Final conclusions can be drawn after the finishing of these tests.

18336 (KFK–4935, pp. 149-159) **Influence of carburizing sodium on creep-fatigue behavior of type 304 steel.** Wada, Y. (Power Reactor and Nuclear Fuel Development Corp., Ibaraki (Japan)); Asayama, T.; Komine, R. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

In carburizing sodium, grain boundaries with coagulation of precipitated carbides were observed in a sodium affected zone for Type 304 steel. It was considered that grain boundaries might crack, when a large distortion of grains occurs within the tertiary creep range. Therefore it should be noticed that this phenomenon might affect creep-fatigue strength. In the present study the creep-fatigue test was carried out in strongly carburizing sodium by inserting a carbon source in sodium near the test specimen at 550 C for Type 304 steel hot rolled plate. Test conditions were as follows: (1) strain range of 0.94%, strain hold time of 1 hr; (2) strain range of 0.98%, strain hold time of 10hrs; and (3) strain range of 0.43%, strain hold time of 1 hr. For tests (1) and (2), many surface cracks were observed. In both cases, main cracks were initiated on grain boundaries of the surface of tested specimens. Creep-fatigue lives of tests (1) and (2) were slightly shorter than those of in-air tests. But for test (3), only a few cracks were observed on the surface of tested specimen and many intergranular micro-cracks were observed in the bulk of metal. Creep-fatigue life was almost same as that of in-air test. It was considered that the main crack of test (3) should be initiated inside of test specimen and the sodium environment could not affect the crack initiation. For higher strain ranges (strain range of about 1%), grain boundaries were distorted cyclically by plastic deformation, and might crack near the surface similar to tertiary creep embrittlement in carburizing sodium. For lower strain ranges, grain boundaries near the surface were deformed elastically because of hardening effect by carburizing, and could not crack. It is recommended that long-time creep-fatigue test should be performed for lower strain ranges for low carbon and nitrogen controlled modified Type 316 steel.

18337 (KFK–4935, pp. 160-162) **Cyclic lifetime change of various types of steels by exposure in alkali metal melts.** Malygin, A.F. (Central Research Inst. of Structural Materials, Prometey (USSR)); Goryacheva, L.A.; Troyanov, V.M.; Trapeznikov, Ju.M. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

The paper considers the generalized mechanisms of cyclic lifetime variation of different steel types by the effect of liquid metal environments at the temperature range of 450-750C. The investigation of corrosion factor influence on the characteristics of steels cyclic strength was performed on the basis of test results comparison in liquid metal - inert media and in air - inert media. The generalized regularities of cyclic lifetime change in alkali metal melts and in air in the wide range of temperature-time loadings versus the corrosion damage characteristics are given. The carbon content change in surface year was non found by specimens tests. The perlitic steels lifetime increase may reach 20 times by frontal corrosion depth and for austenitic steels may reach 8 times.

18338 (KFK–4935, pp. 163-187) **Creep-fatigue behavior of type 304 and 316L(N) in flowing sodium.** Huthmann, H. (Interatom GmbH, Bergisch Gladbach (West Germany)). Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

Low cycle fatigue tests with hold periods up to 24 h have been performed on types 304 and 316L(N) stainless steel in air and in flowing sodium at 550 C. It was shown that the number of cycles to failure decreases with increasing hold times and that the failure mode changes from trans- to intercrystalline fracture. A beneficial effect of sodium occurs under pure cyclic loading and with short hold times. With the longest hold times similar behavior in both environments has been observed. Tests on long term pre-exposed (sodium, 550 C, 10,000 h) specimens show that strong carbide precipitation increases the number of cycles to failure in flowing sodium.

18339 (KFK–4935, pp. 188-204) **The measurement of crack propagation in CT specimens of stainless steel in a sodium environment.** Borgstedt, H.U. (Inst. fur Materialforschung III, Karlsruhe (West Germany)); Frees, G.; Mishra, M.P.; Peric, Z.; Seith, B. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. (IWGFR–84;CONF-9106290–: Properties of structural materials in liquid metal environment, Karlsruhe (Germany), 18-20 Jun 1991). In *Properties of structural materials in liquid metal environment. Proceedings.* 209p. Order Number DE92009398. Source: OSTI; NTIS (US Sales Only).

A test section for fracture mechanic testing of compact tension (CT) specimens was connected to the hot leg of the FARINA sodium loop at KfK. The crack opening displacement (COD) of the specimens was directly measured by means of an encapsulated clip-on-gage which could be used in liquid sodium environment up to the temperature limit of 823 K. The processor calculates the crack length and the factor and the exponent of the Paris law on the basis of the measured COD values. Initially the equipment was used for measuring the fatigue crack growth behavior of pre-cracked CT specimens of Type 304 stainless steel. More recently, the test section was used for the determination of the threshold fatigue crack growth behavior of Type 316 LN stainless steel on such CT specimens at 813 K under stress ratio values greater than 0.6. The results obtained so far do not indicate any significant sodium effects on the near threshold fatigue crack growth behavior of modified Type 316 LN austenitic stainless steel. Modified Type 316 LN base metal had better resistance to fatigue crack growth than Type 316 base metal and Type 16-8-2 weld metal in a sodium environment at 813 K.

18340 (KFK–4972) **Tritium in the tertiary circuit of the compact sodium cooled nuclear reactor plant Karlsruhe (KNK II).** Hanke, H.D.; Noppel, H.E.; Wild, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Radiochemie. Nov 1991. 80p. (In German). Order Number DE92511594. Source: OSTI; NTIS (US Sales Only); INIS.

This report gives a compilation and documentation of all the values measured during twelve years for the experimental program. The data are presented in a stable together with the sampling time and the reactor power of the plant and are plotted together with the reactor power and the operation mode of both cold traps (primary and secondary) in a set of figures. It could be proved that all the tritium in the tertiary circuit is present in the chemical state of HTO by distillation experiments, and by repeated measurements. Therefore, the only sink of HTO in the water stream circuit are losses from the tertiary system into the gaseous waste (turbine condenser off-gas) and into the liquide waste (steam generator drainage during shutdown times). The necessary feed-water addition to the system is a fairly good measure for the losses (about $1m^3$/h). The source of HTO is the tritium diffusion through the steel walls of the steam generators, depending on the tritium content in the secondary circuits (influenced by the reactor power, and by the operation of the cold traps). No change in the tritium behavior was noted after the addition of hydrazine (N_2H_4) for water conditioning was canceled. High tritium values of about 25 Bq/ml have been measured twice, the first time in September 1980 when hydrazine was still added, the second time during April 1984, when the hydrazine treatment was already stopped for several months. The effect of cold trap operation was not always clearly detectable, but obviously the secondary cold trap was more effective than the primary trap. (orig./HP).

18341 (NUREG/CR–5815) **Evaluations of 1990 PRISM design revisions.** Van Tuyle, G.J. (Brookhaven National Lab., Upton, NY (United States)); Slovik, G.C.; Chan, B.C.; Aronson, A.L.; Kennett, R.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (United States). Mar 1992. 210p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52311). Source: OSTI; NTIS; INIS; GPO.

Analyses of the 1990 version of the PRISM Advanced Liquid Metal Reactor (ALMR) design are presented and discussed. Most of the calculations were performed using BNL computer codes, particularly SSC and MINET. In many cases, independent BNL calculations were compared against analyses presented by General Electric when they submitted the PRISM design revisions for evaluation by the Nuclear Regulatory Commission (NRC). The current PRISM design utilizes the metallic fuel developed by Argonne National Laboratory (ANL) which facilitates the passive/"inherent" shutdown mechanism that acts to shut down reactor power production whenever the system overheats. There are a few vulnerabilities in the passive shutdown, with the most worrisome being the positive feedback from sodium density decreases or sodium voiding. Various postulated unscrammed events were examined by GE and/or BNL, and much of the analysis discussed in this report is focused on this category of events. For the most part, the BNL evaluations confirm the information submitted by General Electric. The principal areas of concern are related to the performance of the ternary metal fuel, and may be resolved as ANL continues with its fuel development and testing program.

18342 (WHC-SA–1376) **Reusable fuel test assembly for the FFTF.** Pitner, A.L.; Dittmer, J.O. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920606–15: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92011457. Source: OSTI; NTIS; INIS; GPO Dep.

A fuel test assembly for use in the Fast Flux Test Facility (FFTF) has been developed that provides re-irradiation capability after interim discharge and reconstitution of the test pin bundle. This test vehicle permits irradiation test data to be obtained at multiple exposures on a few select test pins without the substantial expense of fabricating individual test assemblies as would otherwise be required. A variety of different test pin types can be loaded in the reusable test assembly.

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

Refer also to citation(s) 18565

18343 (DOE/ER/12894–3) **Stability of a liquid-film space radiator with internal electrostatic fields: Progress report, October 1, 1991–September 30, 1992.** Bankoff, S.G.; Miksis, M.J. Northwestern Univ., Evanston, IL (United States). Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER12894. Order Number DE92013402. Source: OSTI; NTIS; GPO Dep.

A new concept in light-weight space radiators has been introduced by Kim, Miksis and Bankoff, consisting of a pumped-loop membrane radiator in which leakage of coolant from a puncture, due to micrometeorite or space debris impact, is prevented by the application of an internal electrostatic field. For nuclear space power, the coolant is generally a liquid metal, such as lithium, flowing as a thin film along the interior walls of the hollow radiator. A lightweight fully-modular radiator design is proposed, which is calculated to weight less than 1 kg/m^2. The feature which makes this thin-membrane radiator practical is the internal electrostatic field system, which can stop radiator leaks from punctures, sudden accelerations or accidental tears.

18344 (EGG-M–91517) **Safety questions relevant to nuclear thermal propulsion.** Buden, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). 15 Oct 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920104–33: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92011152. Source: OSTI; NTIS; GPO Dep.

Nuclear propulsion is necessary for successful Mars exploration to enhance crew safety and reduce mission costs. Safety concerns are considered by some to be an implements to the use of nuclear thermal rockets for these missions. Therefore, an assessment was made of the various types of possible accident conditions that might occur and whether design or operational solutions exist. With the previous work on the NERVA nuclear rocket, most of the issues have been addressed in some detail. Thus, a large data base exist to use in an agreement. The assessment includes evaluating both ground, launch, space operations and disposal conditions. The conclusion is that design and operational solutions do exist for the safe use of nuclear thermal rockets and that both the environment and crews be protected against harmful radiation. Further, it is concluded that the use of nuclear thermal propulsion will reduce the radiation and mission risks to the Mars crews.

18345 (UCRL-JC–108960) **Nuclear-driven technologies that could reduce the cost of electricity by several fold.** Heidrich, J.; Carman, T.S.; Chow, T.S.; Condit, R.; Logan, B.G.; Pettibone, J. Lawrence Livermore National Lab., CA (United States). Nov 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9111181–2: 8. biennial nuclear explosives design conference, Albuquerque, NM (United States), 18-22 Nov 1991). Order Number DE92011297. Source: OSTI; NTIS; GPO Dep.

Dramatic reduction in the cost of electricity may potentially be achieved utilizing unconventional nuclear-driven technologies. The cost of electricity has three major contributors; fuel cycle cost, containment cost, and electrical generator (balance of plant) cost. A general discussion is given on the characteristics that nuclear energy sources must have in order to minimize fuel cycle costs. Two unconventional methods are covered for generating electricity with dramatic reduction in cost. One, is a water pump and contains low-technology components. The other is a plasma MHD generator and contains high-technology components that require further development, but may produce electricity at only 1/10 the present cost. A systems economic analysis is outlined that can be used to guide and evaluate the performance of various nuclear-driven electrical generating technologies to be pursued in future work. 11 refs.

18346 (WHC-SA–1258) **SP-100 W/Re thermocouple calibration techniques.** Cannon, N.S.; Knight, R.C. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920423–3: 7. international symposium on temperature: its measurement and control in science and industry, Toronto (Canada), 28 Apr - 1 may 1992). Order Number DE92011302. Source: OSTI; NTIS; GPO Dep.

The accuracy requirement of the SP-100 Temperature Sensor Program for the reference tungsten/rhenium metal-sheathed thermocouple sensor is ±1.4% of the reading (in Kelvin) at space reactor operating temperature (nominally 1375 K) over the operating life of the reactor. This is a stringent requirement considering that the as-fabricated base wire "limits of error" are generally specified at roughly ±1.0% for exposure temperatures above 700 K. Although the thermocouples will be located out of the reactor's neutron field so that irradiation decalibration is expected to be negligible, thermal exposure effects will probably cause the thermocouple to drift out of specification during the 10-yr reactor operating life. A plan to accurately quantify thermocouple drift with aging time, and thus provide on-board calibration for the sensor is described.

2107 Regulation and Licensing

Refer also to citation(s) 18434, 18564, 20631

18347 (AECB-C-83) **Proposed general amendments to the atomic energy control regulations.** Atomic Energy Control Board, Ottawa, ON (Canada). 28 Apr 1986. 93p. Order Number DE92627122. Source: OSTI; NTIS (US Sales Only); INIS.

Canada's Atomic Energy Control Act defines the powers and responsibilities of the Atomic Energy Control Board (AECB). Among these is to make regulations to control the development, application and use of atomic energy. In these proposed general amendments to the Atomic Energy Control Regulations substantial changes are proposed in the designation of the authority of AECB staff, exemptions from licensing, international safeguards, duties of licensees and atomic radiation workers, security of information, and provision for hearings. The scope of the control of atomic energy has been redefined as relating to matters of health, safety, security, international safeguards, and the protection of the environment.

18348 (INIS-mf-13185) **Regulatory research and support program for 1989/90: Project descriptions.** Atomic Energy Control Board, Ottawa, ON (Canada). 15 Mar 1989 163p. Order Number DE92627091. Source: OSTI; NTIS (US Sales Only); INIS. Information bulletin 89-1.

The Regulatory Research and Support Program is intended to augment and extend the Atomic Energy Control Board's regulatory program beyond the capability of in-house resources. The overall objective of the research and support program is to produce pertinent and independent information that will assist the Board and its staff in making correct, timely and credible decisions on regulating nuclear energy. The program is divided into eight main areas of research covering the safety of nuclear facilities, radioactive waste management, health physics, physical security and the development of regulatory processes. A total of 83 projects are planned for 1989/90, including a number which are ongoing from the previous fiscal year. Projects that are held in reserve in case funding becomes available are also listed. Most of the projects will be carried out under contracts issued through the Department of Supply and Services. This Information Bulletin contains a list of the projects with a brief description of each, and additional supporting information.

18349 (NUREG-0304-Vol.16-No.4) **Regulatory and technical reports (Abstract index journal): Annual compilation for 1991: Volume 16, No. 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Mar 1992. 109p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO.

This journal includes all formal reports in the NUREG series prepared by the NRC staff and contractors; proceedings of conferences and workshops; as well as international agreement reports. The entries in this compilation are indexed for access by title and abstract, secondary report number, personal author, subject, NRC organization for staff and international agreements, contractor, international organization, and licensed facility.

18350 (NUREG-0540-Vol.14-No.2) **Title list of documents made publicly available, February 1-29, 1992: Volume 14, No. 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Apr 1992. 340p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This document is a monthly publication containing descriptions of information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author, Corporate Source, Report Number, and Cross Reference of Enclosures to Principal Documents.

18351 (NUREG-0750-Vol.35-No.2) **Nuclear Regulatory Commission issuances, February 1992: Volume 35, No. 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. [1992]. 40p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Director's Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

18352 (NUREG/CR-2000-Vol.11-No.2) **Licensee Event Report (LER) compilation for month of February 1992: Volume 11, No. 2.** Nuclear Regulatory Commission, Washington, DC (United States). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (United States). Nuclear Operations Analysis Center. Mar 1992. 135p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NSIC-200-Vol.11-No.2). Source: OSTI; NTIS; INIS; GPO.

This monthly report contains Licensee Event report (LER) operational information that was processed into the LER data file of the Nuclear Operations Analysis Center (NOAC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in the Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73, Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System, Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

18353 (REG/G-92013174) **Selection, design, qualification, testing, and reliability of emergency diesel generator units used as Class 1E onsite electric power systems at nuclear power plants: Draft Regulatory Guide DG-1021 (Second proposed revision 3 to Regulatory Guide 1.9, previously issued as Task RS 802-5).** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Apr 1992. 24p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS.

This guide has been prepared for the resolution of Generic Safety Issue B-56, "Diesel Generator Reliability," and is related to Unresolved Safety Issue (USI) A-44, "Station Blackout." The resolution of USI A-44 established a need for an emergency diesel generator (EDG) reliability program that has the capability to achieve and maintain the emergency diesel generator reliability levels in the range of 0.95 per demand or better to cope with station blackout.

18354 (WSRC-TR-90-261) **Knowledges and abilities catalog for nuclear power plant operators: Savannah River Site (SRS) production reactors.** Westinghouse Savannah River Co., Aiken, SC (United States). 20 Jun 1990. 196p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011255. Source: OSTI; NTIS; INIS; GPO Dep.

The Knowledges and Abilities Catalog for Nuclear Power Plant Operations: Savannah River Site (SRS) Production Reactors, provides the basis for the development of content-valid certification examinations for Senior Reactor Operators (SROs) and Central Control Room Supervisors (SUP). The position of Shift Technical

Engineer (STE) has been included in the catalog for completeness. This new SRS reactor operating shift crew position is held by an individual holding a CCR Supervisor Certification who has received special engineering and technical training. Also, the STE has a Bachelor of Science degree in engineering or a related technical field. The SRS catalog contains approximately 2500 knowledge and ability (K/A) statements for SROs and SUPs at heavy water moderated production reactors. Each K/A statement has been rated for its importance to the safe operation of the plant in a manner ensuring the health and safety of the public. The SRS K/A catalog is presently organized into five major sections: Plant Systems grouped by Safety Function, Plant Wide Generic K/As, Emergency Plant Evolutions, Theory and Components (to be developed).

2108 Economics

Refer also to citation(s) 18345, 18355

2109 Process Heat Reactors

Refer also to citation(s) 18427, 18428

18355 (AECL--9982) **The prospects for nuclear heating in Hungary.** Lynch, G.F.; Papp, I. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1989. 22p. (CONF-890901--: 14. world energy conference, Montreal (Canada), 17-22 Sep 1989). Order Number DE92626959. Source: OSTI; NTIS (US Sales Only); INIS.

Hungary supplies only half of its energy requirements from domestic resources and is very dependent upon imports of oil, natural gas and electricity to meet the current demand. In planning to reduce the dependence on imports, nuclear technology is considered an important element in the long-term energy strategy. To this end, an aggressive nuclear electricity generation program is being implemented with four 440 MWe units now operating and two 1000 MWe units committed. However, nuclear technology must be used in other energy sectors if the goal of long-term energy independence is to be achieved. On the demand side, 30% of the primary energy is consumed in the public sector, the major component being residential heating. Of the 3.7 million apartments in Hungary, 500 000 benefit from being connected to municipal district heating systems that use natural gas or oil as the energy base. This is, therefore, another significant energy sector that is amenable to using nuclear technology to substitute for imported oil and natural gas. In assessing alternative nuclear heat sources, a joint study was undertaken between Canada and Hungary to determine the feasibility of using the SLOWPOKE Energy System that has recently been developed. The SLOWPOKE Energy System is a benign nuclear heat source designed to supply 10 thermal megawatts in the form of hot water for local heating systems in buildings and institutions. It uses a combination of inherent safety features, including natural convection circulation and negative reactivity coefficients, and engineered features to ensure an extremely safe system. A SLOWPOKE demonstration heating reactor has been constructed in Canada. The unit started operation in 1987 July and is currently undergoing an extensive test program.

22 NUCLEAR REACTOR TECHNOLOGY

18356 (INIS-SU--307) **Nuclear engineering and technology: Scientific-technical collection.** Voprosy atomnoj nauki i tekhiki. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1990 44p. (In Russian). Order Number DE92001354. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are processed separately for the database. (DLC)

2201 Theory and Calculation

Refer also to citation(s) 18290, 18395, 20257, 20562

18357 (PEL--309) **LABAN-PEL: a two-dimensional, multigroup diffusion, high-order response matrix code.** Mueller, E.Z. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jun 1991. 36p. Order Number DE92626845. Source: OSTI; NTIS (US Sales Only); INIS.

The capabilities of LABAN-PEL is described. LABAN-PEL is a modified version of the two-dimensional, high-order response matrix code, LABAN, written by Lindahl. The new version extends the capabilities of the original code with regard to the treatment of neutron migration by including an option to utilize full group-to-group diffusion coefficient matrices. In addition, the code has been converted from single to double precision and the necessary routines added to activate its multigroup capability. The coding has also been converted to standard FORTRAN-77 to enhance the portability of the code. Details regarding the input data requirements and calculational options of LABAN-PEL are provided. 13 refs.

18358 (PEL--314) **Solution of benchmark NEACRP-L-336 using RED 1.0.** Joubert, W.R. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Dec 1991. 80p. Order Number DE92626914. Source: OSTI; NTIS (US Sales Only); INIS.

Also available on diskette from the author.

The results obtained at the Atomic Energy Corporation of South Africa for the proposed benchmark calculations are described. These results are also given in the prescribed format on a diskette labelled ^{R}ED-1· The flux and production rates for the five configurations are given. The FORTRAN-77 program is used to produce the results on paper. Only results from the first part of the benchmark (K1) are given, since it was not possible to consistently do flux reconstruction from the nodal code, as required for the second part (K2). 12 figs., 67 tabs., 9 refs.

18359 (PEL--315) **Solution of benchmark NEACRP-L-336 using RED 2.0.** Joubert, W.R. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Dec 1991. 79p. Order Number DE92626915. Source: OSTI; NTIS (US Sales Only); INIS.

Also available on diskette from the author.

The results obtained at the Atomic Energy Corporation of South Africa for the proposed benchmark calculations are described. These results are also given in the prescribed format on a diskette labelled ^{R}ED-2· The flux and production rates for the five configurations are given. The FORTRAN-77 program is used to produce the results on paper. Only results from the first part of the benchmark (K1) are given, since it was not possible to consistently do flux reconstruction from the nodal code, as required for the second part (K2). 12 figs., 67 tabs., 5 refs.

18360 (WHC-SA--1323) **One-group power and frequency responses of arbitrary time-dependent reactivity oscillation.** Lan, J.S.; Omberg, R.P. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920538--17: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011452. Source: OSTI; NTIS; INIS; GPO Dep.

One-group analytical solutions of both direct power response and frequency response to arbitrary time-dependent reactivity oscillations are obtained. In regard to the power response, the solution can be derived from the method of singular perturbation for an arbitrary input oscillation. With the differential equations describing a source-free reactor under arbitrary reactivity changes at various time steps, it is possible to integrate the precursor balance equation through the application of prompt-jump approximation to the neutron balance equation. In regard to the frequency response, the solution is obtained by means of Fourier series expansion of arbitrary periodic input, and through the reactivity transfer function of the prompt-jump approximation. The uniqueness of these analytical solutions is that they can cover an unlimited number of oscillatory cycles with a few simple mathematical functions. These analytical solutions set down very practical groundwork with a wide spectrum of control characteristics for any reactor-kinetics code verification. Initial comparison with the K-III code calculation in fast reactor examples shows excellent results. Though the technique is demonstrated only for the one-group problem, a close form solution is difficult to come by.

2202 Components and Accessories

Refer also to citation(s) 18353, 18379, 18380, 18410, 18413, 18422, 18433, 18564, 18573, 18864, 19080, 19083

18361 (AECL–10298) **A summary of the Chalk River valve packing evaluation program 1985 - 1990.** Aikin, J.A.; Doubt, G.L.; Lade, C.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.; Ontario Hydro, Toronto, ON (Canada). Dec 1990. 19p. (CONF-9003319–: Bruce 'B' maintenance conference, Tiverton (Canada), 15 Mar 1990; COG–90-148.). Order Number DE92626849. Source: OSTI; NTIS (US Sales Only); INIS.

The move away from asbestos-based valve packing products has generated concern among valve manufacturers, packing manufacturers and user groups about the reliability and safety of non-asbestos based products for long-term use. AECL Research, Chalk River, has been actively evaluating these new valve packing products since 1985. This report describes the work done at Chalk River from 1985 to 1990. The report includes both Electric Power Research Institute (EPRI) and CANDU Owners Group (COG) funded studies. A description of the test programs and a brief summary of the functional performance of the more successful materials (die-formed graphite, braided asbestos and braided non-asbestos) on friction, stem leakage and consolidation are provided. At this time, Chalk River and Ontario Hydro have approved the following packing arrangements: for non-live-loaded valves, the recommended replacements packing for braided asbestos is combination flexible graphite packing sets; and, for heavy water valves originally designed with JC187I, the recommended replacement packing is approved braided-asbestos products.

18362 (AECL–10459) **A state of the art report on flame acceleration and transition to detonation in hydrogen/air/diluent mixtures.** Chan, C.K.; Tennankore, K.N. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Dec 1991. 44p. Order Number DE92626850. Source: OSTI; NTIS (US Sales Only); INIS.

Accidental ignition in pockets of flammable hydrogen/air/diluent mixtures will lead to a deflagration wave (slow flame). Particular conditions can accelerate this flame and cause a transition from deflagration to a detonation wave (rapid flame), with its associated spatially non-uniform and very high pressures. In this report, the differences between deflagration and detonation are outlined, and the various flame acceleration mechanisms, along with the related research results, are reviewed. The current understanding of transition to detonation as a two-step process, a local explosion followed by an amplification of the resulting blast wave into a detonation wave, is described in detail. Occurrence of a local explosion in hot spots generated by the focussing of shock waves existing ahead of a fast flame, or in high-reactivity centres generated by turbulence-induced rapid mixing of flame and unburnt gas, and the resulting local quenching of the flame, are described and relevant publications are cited. The current models for flame acceleration are listed and their limitations are identified. Also, the available qualitative criteria for assessing the likelihood of transition to detonation under given conditions are briefly discussed. The feasibility of developing a quantitative methodology for assessing this likelihood is discussed, and further more work required to complete this development is outlined. The development of a quantitative methodology is recommended.

18363 (CONF-920375–9) **Power reactor embrittlement data base (PR-EDB): Uses in evaluating radiation embrittlement of reactor vessels.** Kam, F.B.K.; Stallmann, F.W.; Wang, J.A. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92011040. Source: OSTI; NTIS; INIS; GPO Dep.

Investigations of regulatory issues such as vessel integrity over plant life, vessel failure, and sufficiency of current Codes, Standard Review Plans (SRPs), and Guides for license renewal can be greatly expedited by the use of a well-designed, computerized data base. Also, such a data is essential for the evaluation of embrittlement prediction models by researchers. The Power Reactor Embrittlement Data Base (PR-EDB) is such a comprehensive collection of data for US commercial nuclear reactors. The current compilation contains data from 92 reactors and consists of 175 data points for weld materials (79 different welds) and 395 data points for base materials (110 different base materials). The different types of data that are implemented or planned for this data base are discussed. "User-friendly" utility programs have been written to investigate a list of problems using this data base. The utility programs are also used to add and upgrade data, retrieve and select specific data, manipulate data, display data to the screen or printer, and to fit and plot Charpy impact data. The results of several studies investigated are presented in this paper.

18364 (DPSP–63-1192) **Process area radiation levels.** Brickhouse, W.H. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 8 Mar 1963. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (RTR–480). Order Number DE92011350. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A knowledge of trends in process are radiation levels and process system activities during shutdown, in relationship to operating parameters, is of interest in connection with current and future maintenance of reactor equipment. Information concerning the severity, causes, and behavior of process system shutdown activities as operation continues is necessary in support of programs designed to alleviate maintenance problems caused by radioactivity. Reference documents No. 1, 2, and 3 present observed trends in representative radiation levels during shutdown in each of the 100 Areas, in association with related operating variables, for the period April 1956 to February 1962. This document extends similar information to the present data.

18365 (INFO–0337) **Cold water injection into two-phase mixtures.** Atomic Energy Control Board, Ottawa, ON (Canada). Jul 1989. 128p. Order Number DE92628186. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the results of a review of the international literature regarding the dynamic loadings associated with the injection of cold water into two-phase mixtures. The review placed emphasis on waterhammer in nuclear power plants. Waterhammer incidence data were reviewed for information related to thermalhydraulic conditions, underlying causes and consequential damage. Condensation induced waterhammer was found to be the most significant consequence of injecting cold water into a two-phase system. Several severe waterhammer incidents have been attributed to slug formation and steam bubble collapse under conditions of stratified steam and cold water flows. These phenomena are complex and not well understood. The current body of experimental and analytical knowledge is not large enough to establish maps of expected regimes of condensation induced waterhammer. The Electric Power Research institute, in the United States, has undertaken a major research and development programme to develop the knowledge base for this area. The limited models and data currently available show that mechanical parameters are as important as thermodynamic conditions for the initiation of condensation induced waterhammer. Examples of bounds for avoiding two-phase waterhammer are given. These bounds are system specific and depend upon parameters such as pump capacity, pipe length and pipe orientation.

18366 (INIS-mf–13159, pp. 75-79) **Possibilities of increasing the steam generator feedwater quality.** Toman, J. (Vyzkumny Ustav Energeticky, Prague (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The water quality is primarily determined by the blowdown and sludge from the steam generator. The water should contain the lowest possible amounts of salts, particularly chlorides, and of corrosion products, particularly copper oxides. Salts originate from leaks in the condenser, from chemicals added, and from salt leachates from ion exchangers used in the turbine condensate treatment. Provided that the condenser is perfectly sealed and its operation is highly reliable, it is more convenient (from the point of view of the salt content in the steam generator water) to operate the secondary circuit without treatment of the turbine condensate, because the amount of salts brought to the secondary circuit with the alkalinizing agent will decrease. The erosion corrosion of unalloyed carbon steels in the secondary circuit is a serious problem because the concentration of iron in feedwater is thereby increased considerably, with increased demands on the maintenance, repairs and replacement of components. (M.D.). 1 tab.

18367 (NUREG/CR–4599-Vol.1-No.2) **Short cracks in piping and piping welds: Semiannual report, October 1990–March 1991: Volume 1, No. 2.** Wilkowski, G.M. (Battelle, Columbus, OH (United States)); Brust, F.; Francini, R.; Ghadiali, N.; Kilinski, T.; Krishnaswamy, P.; Landow, M.; Marschall, C.W.; Rahman, S.; Scott, P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Battelle, Columbus, OH (United States). Apr 1992. 203p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (BMI–2173-Vol.1-No.2). Source: OSTI; NTIS; INIS; GPO.

This is the second semiannual report of the US Nuclear Regulatory Commission's Short Cracks in Piping and Piping Welds research program. The program began in March 1990 and will extend for 4 years. The intent of this program is to verify and improve fracture analyses for circumferentially cracked large-diameter nuclear piping with crack sizes typically used in leak-before-break analyses or in-service flaw evaluations. Only quasi-static loading rates are evaluated since the NRC's International Piping Integrity Research Group (IPIRG) program is evaluating the effects of seismic loading rates on cracked piping systems. Progress for through-wall-cracked pipe involved (1) conducting a 28-inch diameter stainless steel SAW and 4-inch diameter French TP316 experiments, (2) conducting a matrix of FEM analyses to determine GE/EPRI functions for short TWC pipe, (3) comparison of uncracked pipe maximum moments to various analyses and FEM solutions, (4) development of a J-estimation scheme that includes the strength of both the weld and base metals. Progress for surface-cracked pipe involved (1) conducting two experiments on 6-inch diameter pipe with $d/t = 0.5$ and $\Theta/\pi = 0.25$ cracks, (2) comparisons of the pipe experiments to Net-Section-Collapse predictions, and (3) modification of the SC.TNP and SC.TKP J-estimation schemes to include external surface cracks.

18368 (NUREG/CR–5785) **Experimental results of tests to investigate flaw behavior of mechanically loaded stainless steel clad plates.** Iskander, S.K. (Oak Ridge National Lab., TN (United States)); Robinson, G.C.; Corwin, W.R.; Oland, B.C.; Alexander, D.J.; Cook, K.V. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Oak Ridge National Lab., TN (United States). Apr 1992. 202p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–11950). Source: OSTI; NTIS; INIS; GPO.

A small crack near the inner surface of cold nuclear reactor pressure vessels in an important consideration in the safety assessment of the structural integrity of the vessel. Four-point bend tests on large plate specimens, six clad and two unclad, were performed to determine the effect of stainless steel cladding upon the propagation of small surface cracks subjected to stress states similar to those produced by pressurized thermal shock conditions. Results of tests at temperatures 10 and 60°C below the nil-ductility transition temperature have shown that a tough surface layer composed of cladding and heat-affected zone has arrested running flaws in clad plates under conditions where unclad plates have ruptured. Furthermore, the load-bearing capacity of clad plates with large subclad flaws significantly exceeded that of an unclad plate with a much smaller flaw. More testing is necessary to unambiguously single out whether it is the cladding or the heat-affected zone that is primarily responsible for the observed enhanced load-bearing capacity of plates. The compressive stresses that limited the depth to which the flaw could propagate are absent in a repressurization event. Nonetheless, the experiments show that if the surface layer is sufficiently tough, it could prevent a flaw, near the surface, from propagating along the surface. The flaw could tunnel below the surface, but a sufficiently tough surface layer would reduce the maximum stress intensity factor.

2203 Fuel Elements

Refer also to citation(s) 18871, 20548

18369 (INIS-SU–309/A, pp. 105-112) **BN-600 fuel elements and fuel assemblies operating experience.** Mal'tsev, V.V.; Ogorodov, A.N.; Roslyakov, V.F.; Sergeev, G.A.; Shejnkman, A.G. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Consideration is given to the data on fuel burnup of standard fuel assemblies of the BN-600 reactor first core charge and that for modified core; data on operation ability of fuel assemblies of the first charge type are given. Data on main results of primary post-irradiation examination of fuel assemblies and fuel elements and maximal values of fuel burnup, achieved in particular fuel assemblies of BN-600 reactor are presented. 4 figs.; 1 tab.

2204 Control Systems

Refer also to citation(s) 18448, 18463, 18469, 18470, 18471, 18510

18370 (AECL–8958) **Computer-aided control system design.** Lebenhaft, J.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jan 1986. 38p. Order Number DE92626865. Source: OSTI; NTIS (US Sales Only); INIS.

Control systems are typically implemented using conventional PID controllers, which are then tuned manually during plant commissioning to compensate for interactions between feedback loops. As plants increase in size and complexity, such controllers can fail to provide adequate process regulations. Multivariable methods can be utilized to overcome these limitations. At the Chalk River Nuclear Laboratories, modern control systems are designed and analyzed with the aid of MVPACK, a system of computer programs that appears to the user like a high-level calculator. The software package solves complicated control problems, and provides useful insight into the dynamic response and stability of multivariable systems.

18371 (ANL/CP–72713) **The use of modern control methods to improve fast reactor safety and availability.** Vilim, R.B. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–15: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011841. Source: OSTI; NTIS; INIS; GPO Dep.

The development of metal fuel for fast reactors has created a new opportunity for innovation in plant control. By exploiting the superior neutronics properties of metal fuel, the reactivity burnup swing can be made zero, obviating the need for control rod reactivity addition over life. This result can be used to simplify elements of the plant control and protection system, the goal being improved plant safety and availability. These simplifications, however, depend on the development of methods for improved reactor inlet temperature control and reactivity feedback monitoring. The use of modern control theory to develop these methods is described.

18372 (ANL/CP–72713) **The use of modern control methods to improve liquid-metal reactor safety and availability.** Vilim, R.B. Argonne National Lab., IL (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911014–2: International conference on dynamics and control in nuclear power stations; 8. power plant dynamics, control and testing symposium, London (United Kingdom); Knoxville, TN (United States), 22-24 Oct 1991; 27-29 may 1992; CONF-920538–15). Order Number DE91018616. Source: OSTI; NTIS; INIS; GPO Dep.

The development of metal fuel for fast reactors has created a new opportunity for innovation in plant control. By exploiting the superior neutronics properties of metal fuel, the reactivity burnup swing can be made zero, obviating the need for control rod reactivity addition over life. This result can be used to simplify elements of the plant control and protection system, the goal being improved plant safety and availability. These simplifications, however depend on the development of methods for improved reactor inlet temperature control and reactivity feedback monitoring. The use of modern control theory to develop these methods is described. 10 refs., 4 figs.

18373 (ANL/CP-74391) **EBR-II Cover Gas Cleanup System (CGCS) upgrade graphical interface design.** Staffon, J.D.; Peters, G.G. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–19: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011838. Source: OSTI; NTIS; INIS; GPO Dep.

Technology advances in the past few years have prompted an effort at Argonne National Laboratory to replace existing equipment with high performance digital computers and color graphic displays. Improved operation of process systems can be achieved by utilizing state-of-the-art computer technology in the areas of process control and process monitoring. The Cover Gas Cleanup System (CGCS) at EBR-II is the first system to be upgraded with high performance digital equipment. The upgrade consisted of a main control computer, a distributed control computer, a front end input/output computer, a main graphics interface terminal, and a remote graphics interface terminal. This paper describes the main control computer and the operator interface control software.

18374 (ANL/CP-74392) **Surveillance application using patten recognition software at the EBR-II Reactor Facility.** Olson, D.L. Argonne National Lab., Idaho Falls, ID (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–15: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011842. Source: OSTI; NTIS; INIS; GPO Dep.

The System State Analyzer (SSA) is a software based pattern recognition system. For the past several year this system has been used at Argonne National Laboratory's Experimental Breeder Reactor 2 (EBR-2) reactor for detection of degradation and other abnormalities in plant systems. Currently there are two versions of the SSA being used at EBR-2. One version of SSA is used for daily surveillance and trending of the reactor delta-T and startups of the reactor. Another version of the SSA is the QSSA which is used to monitor individual systems of the reactor such as the Secondary Sodium System, Secondary Sodium Pumps, and Steam Generator. This system has been able to detect problems such as signals being affected by temperature variations due to a failing temperature controller.

18375 (ANL/CP-74459) **EBR-II Cover Gas Cleanup System upgrade process control system structure.** Carlson, R.B.; Staffon, J.D. Argonne National Lab., Idaho Falls, ID (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–21: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011836. Source: OSTI; NTIS; INIS; GPO Dep.

The Experimental Breeder Reactor II (EBR-II) Cover Gas Cleanup System (CGCS) control system was upgraded in 1991 to improve control and provide a graphical operator interface. The upgrade consisted of a main control computer, a distributed control computer, a front end input/output computer, a main graphics interface terminal, and a remote graphics interface terminal. This paper briefly describes the Cover Gas Cleanup System and the overall control system; describes the main control computer hardware and system software features in more detail; and, then, describes the real-time control tasks, and how they interact with each other, and how they interact with the operator interface task.

18376 (ANL/CP-74461) **EBR-II Cover Gas Cleanup System upgrade distributed control and front end computer systems.** Carlson, R.B. Argonne National Lab., IL (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–20: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011837. Source: OSTI; NTIS; INIS; GPO Dep.

The Experimental Breeder Reactor II (EBR-II) Cover Gas Cleanup System (CGCS) control system was upgraded in 1991 to improve control and provide a graphical operator interface. The upgrade consisted of a main control computer, a distributed control computer, a front end input/output computer, a main graphics interface terminal, and a remote graphics interface terminal. This paper briefly describes the Cover Gas Cleanup System and the overall control system; gives reasons behind the computer system structure; and then gives a detailed description of the distributed control computer, the front end computer, and how these computers interact with the main control computer. The descriptions cover both hardware and software.

18377 (ANL/CP-75747) **A universal, fault-tolerant, non-linear analytic network for modeling and fault detection.** Mott, J.E. (Advanced Modeling Techniques Corp., Idaho Falls, ID (United States)); King, R.W.; Monson, L.R.; Olson, D.L.; Staffon, J.D. Argonne National Lab., Idaho Falls, ID (United States). 6 Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538–14: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011840. Source: OSTI; NTIS; INIS; GPO Dep.

The similarities and differences of a universal network to normal neural networks are outlined. The description and application of a universal network is discussed by showing how a simple linear system is modeled by normal techniques and by universal network techniques. A full implementation of the universal network as universal process modeling software on a dedicated computer system at EBR-II is described and example results are presented. It is concluded that the universal network provides different feature recognition capabilities than a neural network and that the universal network can provide extremely fast, accurate, and fault-tolerant estimation, validation, and replacement of signals in a real system.

18378 (CONF-920375–5) **Managing the aging of BWR control rod drive systems.** Greene, R.H. (Oak Ridge National Lab., TN (United States)); Farmer, W.S. Oak Ridge National Lab., TN (United States). [1992]. 22p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92010435. Source: OSTI; NTIS; INIS; GPO Dep.

This Phase I Nuclear Plant Aging Research (NPAR) study examines the aging phenomena associated with BWR control and rod drive mechanisms (CRDMs) and assesses the merits of various methods of "imaging" this aging. Information for this study was acquired from (1) the results of a special CRDM aging questionnaire distributed to each US BWR utility, (2) a first-of-its-kind workshop held to discuss CRDM aging and maintenance concerns, (3) an analysis of the Nuclear Plant Reliability Data System (NPRDS) failure cases attributed to the control rod drive (CRD) system, and (4) personal information exchange with nuclear industry CRDM maintenance experts. The report documenting the findings of this research, NUREG-5699, will be published this year. Nearly 23% of the NPRDS CRD system component failure reports were attributed to the CRDM. The CRDM components most often requiring replacement due to aging are the Graphitar seals. The predominant causes of aging for these seals are mechanical wear and thermal embrittlement. More than 59% of the NPRDS CRD system failure reports were attributed to components that comprise the hydraulic control unit (HCU). The predominant HCU components experiencing the effects of service wear and aging are value seals, discs, seats, stems, packing, and diaphragms.

18379 (CONF-920375–11) **Assessment of diagnostic methods for determining degradation of motor-operated valves.** Haynes, H.D. (Oak Ridge National Lab., TN (United States)); Farmer, W.S. Oak Ridge National Lab., TN (United States). [1992]. 29p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States);

24-27 Mar 1992. Order Number DE92011078. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has carried out a comprehensive aging assessment of motor-operated valves (MOVs) in support of the Nuclear Plant Aging Research (NPAR) program. This paper provides a summary of the ORNL MOV aging assessment with emphasis on the identification, evaluation, and application of MOV monitoring methods and techniques. The diagnostic information available from any MOV measurable parameters was evaluated by ORNL using MOVs that were mounted on test stands. Those tests led to the conclusion that the single most informative MOV measurable parameter was also the one which was most easily acquired, namely the motor current. Motor current signature analysis (MCSA) was found to provide detailed information related to the condition of the motor, motor operator, and valve across a wide range of levels. As part of the MOV aging assessment, several tests were carried out by ORNL on MOVs having implanted defects and degradations. Tests were also performed on many MOVs located within a nuclear power plant. In addition, ORNL participated in the Gate Valve Flow Interruption Blowdown Test program carried out at Wyle Laboratories in Huntsville, Alabama. Results from all of these tests are summarized in this paper and several selected examples are given. Other areas covered in this paper include descriptions of relevant regulatory issues and activities, other related diagnostics research at ORNL, and interactions ORNL has had with outside organizations for the purpose of disseminating research results.

18380 (CONF-920375–12) **Assessment of diagnostic methods for determining degradation of check valves.** Haynes, H.D. (Oak Ridge National Lab., TN (United States)); Farmer, W.S. Oak Ridge National Lab., TN (United States). [1992]. 29p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92011079. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has carried out a comprehensive aging assessment of check valves in support of the Nuclear Plant Aging Research (NPAR) program. This paper provides a summary of the ORNL check valve aging assessment with emphasis on the identification, evaluation, and application of check valve monitoring methods and techniques. Several check valve monitoring methods are described and compared. These methods include: acoustic emission monitoring, ultrasonic inspection, magnetic flux signature analysis (MFSA), external magnetics. These diagnostic technologies were shown to be useful in determining check valve condition (e.g., disc position, disc motion, and seat leakage), although none of the methods was by itself, successful in monitoring all three condition indicators. The combination of acoustic emission with either ultrasonics or one of the magnetic technologies, however, yields a monitoring system that succeeds in providing the sensitivity to detect all major check valve operating conditions. Other areas covered in the paper include descriptions of relevant regulatory issues, utility group activities, and interactions ORNL has had with outside organizations for the purpose of disseminating research results.

18381 (CONF-920538–23) **Wavelets and the generation of time-dependent power spectral densities.** Perez, R.B. (Tennessee Univ., Knoxville, TN (United States). Dept. of Nuclear Engineering); Mattingly, J.K.; March-Leuba, C.; de Saussure, G. Oak Ridge National Lab., TN (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92013410. Source: OSTI; NTIS; GPO Dep.

Signal analysis in the nuclear engineering field has been mostly based on the study of signal power spectral density (PSD) in the frequency domain. Indeed, the shape and magnitude of the PSD provides valuable information about the physical system and, when combined with suitable models, affords a method for the determination of system parameters. Consider now sensor signals that are the superposition of various signals, arising from distinct causative mechanisms within the system. In this instance, the signal spectrum could change quite suddenly because of the occurrence of transitions to new modes of signal generation. For this reason, there has been interest in determining the signal PSD as a function of time. In particular, one may inquire about the time of appearance of abrupt signal changes amidst the background noise, and about the evolution of the spectrum afterwards. However, this information is lost since the usual Fourier transform methods involve integration over the time domain yielding only global quantities. An acceptable algorithm for the construction of time-dependent spectra should satisfy two basic properties: (1) the contributions from different frequency bands should be kept reasonably separated (i.e., minimum band to band interference) and (2) there must be a rigorous and robust way of reconstructing the original signal from the transformed data.

18382 (CONF-920538–24) **Representation of neutron noise data using neural networks.** Korsah, K.; Damiano, B.; Wood, R.T. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92013232. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a neural network-based method of representing neutron noise spectra using a model developed at the Oak Ridge National Laboratory (ORNL). The backpropagation neural network learned to represent neutron noise data in terms of four descriptors, and the network response matched calculated values to within 3.5 percent. These preliminary results are encouraging, and further research is directed towards the application of neural networks in a diagnostics system for the identification of the causes of changes in structural spectral resonances. This work is part of our current investigation of advanced technologies such as expert systems and neural networks for neutron noise data reduction, analysis, and interpretation. The objective is to improve the state-of-the-art of noise analysis as a diagnostic tool for nuclear power plants and other mechanical systems.

18383 (PEL–300) **The preparation of cross section data for the ESKOM Koeberg reactor vessel surveillance capsule program.** Stoker, C.C. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jan 1991. 40p. Sponsored by Electricity Supply Commission, Johannesburg (South Africa). Order Number DE92626866. Source: OSTI; NTIS (US Sales Only); INIS.

The Reactor Theory Division of the AEC has been contracted by ESKOM (South Africa) to prepare cross section data for the surveillance specimens as part of the overall reactor vessel surveillance (RVS) program. Spectrum averaged one energy group cross sections for the $Cu_{63}(n,\alpha)$, $Ni_{58}(n,p)$, $Fe_{54}(n,p)$, $U_{238}(n,f)$ and $Np_{237}(n,f)$ reactions, has been defined. These cross sections were then used in conjunction with dosimetry measurements to obtain preliminary estimates of the fluence exposure of the surveillance specimens. The basic calculational procedure employed to obtain the spectrum averaged cross sections in the position of the capsule (outside the thermal pads) and the spectrum averaged cross sections are given. A sensitivity analysis of several parameters is involved with a view to determine a suitable error bound for the spectrum averaged cross sections. Comparisons are made with the literature and final conclusions are drawn and some perspective on future calculations is given. 2 figs., 3 tabs., 16 refs.

18384 (RISO-R–609) **Simulation of a PWR power plant for process control and diagnosis.** Ravnsbjerg Nielsen, F. Risoe National Lab., Roskilde (Denmark). Dec 1991. 50p. Order Number DE92628190. Source: OSTI; NTIS (US Sales Only); INIS.

A computer model of a simplified pressurized nuclear power plant is developed with aim at studies concerning process control, diagnosis and decision making. The model includes the traditional PWR plant components, primary circuit with reactor, pressurizer and steam generator, steam circuit with steam line, turbine and condenser, interconnected with pumps, valves and controllers. The model can be used for calculation of transients for both normal operation and incidents such as turbine trip, loss of feedwater, run down of pumps or various valve failures. The computer model is not directed to any specific existing plant. For convenience and alleviation in implementation the physical description of many components are simplified to an extent where the qualitative behavior of the system is not violated. For computer memory economy a variety of thermodynamical functions for water and steam have been approximated with analytical expressions based on table values. The model is implemented in the C language and has been run on both the IBM PC and the SUN workstation. (au) 8 tabs., 25 ills., 10 refs.

2205 Environmental Aspects

Refer also to citation(s) 18282, 18288, 18364, 18428, 18431, 18440, 18559, 19556, 19564, 19875

18385 (INFO–0210) **Radioactive release data from Canadian nuclear generating stations 1972 to 1985.** Atomic Energy Control Board, Ottawa, ON (Canada). Sep 1986. 18p. Order Number DE92626946. Source: OSTI; NTIS (US Sales Only); INIS.

A series of tables present the annual derived release limits for radionuclides from nuclear generating stations in Canada (airborne tritium, iodine, noble gases and particulates; waterborne tritium and gross beta and gamma). Release data are tabulated for gaseous and liquid effluents for the Canadian nuclear power plants (Pickering A and B, Douglas Point, NPD, Bruce A and B, Gentilly 1 and 2, and Point Lepreau) for the years 1972 to 1985.

18386 (INIS-mf–13183, pp. 41) **Assessment of the source term following a postulated severe accident in nuclear reactors.** Theron, M.E. (Electricity Supply Commission, Johannesburg (South Africa)); Taviv, E. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. REACTOR ACCIDENTS/source terms; AEROSOLS; FALLOUT; OUTAGES; POWER LOSSES; RADIATION HAZARDS; RADIOACTIVE MATERIALS; S CODES; ZION-1 REACTOR; ZION-2 REACTOR

18387 (INIS-mf–13183, pp. 41) **The council for nuclear safety's methodology for the assessment of risk to the operator as a result of accidents.** Keenan, N.H. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RISK ASSESSMENT/accidents; NUCLEAR OPERATORS; PUBLIC HEALTH; RADIATION PROTECTION; ACCIDENTS; SAFETY STANDARDS; SOUTH AFRICAN ORGANIZATIONS

18388 (INIS-mf–13183, pp. 42) **The probabilistic accident consequence assessment code.** Schuykens, D.M. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIATION ACCIDENTS/radiation hazards; C CODES; EARTH ATMOSPHERE; EMERGENCY PLANS; FALLOUT; INTERNATIONAL COOPERATION; M CODES; MODIFICATIONS; NUCLEAR POWER PLANTS; O CODES; PROBABILISTIC ESTIMATION; QUALITY ASSURANCE; RADIOACTIVE MATERIALS; RISK ASSESSMENT; SAFETY STANDARDS; SITE SURVEYS; SOUTH AFRICAN ORGANIZATIONS

18389 (INIS-mf–13183, pp. 42) **Nuclear emergency planning: A detailed strategy site or area decontamination following a nuclear accident.** Bright, J.A. (Electricity Supply Commission, Melkbosstrand (South Africa). Koeberg Nuclear Power Station). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. REACTOR ACCIDENTS/decontamination; CALIBRATION; COMPUTER CODES; CONTAMINATION; COST; EMERGENCY PLANS; EQUIPMENT; RADIATION MONITORING; DECONTAMINATION; RESOURCES; WORK

18390 (INIS-mf–13183, pp. 42) **Factors which influence the retention of radioactive iodine and cesium following a severe accident at a pressurized water reactor.** Gil Posadas, C. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. REACTOR ACCIDENTS/cesium; REACTOR ACCIDENTS/iodine; FALLOUT; PWR TYPE REACTORS; RADIOACTIVE MATERIALS; CESIUM; IODINE; S CODES; SOURCE TERMS; SOUTH AFRICAN ORGANIZATIONS

18391 (NUREG/CR–5732) **Iodine chemical forms in LWR severe accidents: Final report.** Beahm, E.C. (Oak Ridge National Lab., TN (United States)); Weber, C.F.; Kress, T.S.; Parker, G.W. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Oak Ridge National Lab., TN (United States). Apr 1992. 86p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–11861). Source: OSTI; NTIS; INIS; GPO.

Calculated data from seven severe accident sequences in light water reactor plants were used to assess the chemical forms of iodine in containment. In most of the calculations for the seven sequences, iodine entering containment from the reactor coolant system was almost entirely in the form of CsI with very small contributions of I or HI. The largest fraction of iodine in forms other than CsI was a total of 3.2% as I plus HI. Within the containment, the CsI will deposit onto walls and other surfaces, as well as in water pools, largely in the form of iodide (I^-). The radiation-induced conversion of I^- in water pools into I_2 is strongly dependent on pH. In systems where the pH was controlled above 7, little additional elemental iodine would be produced in the containment atmosphere. When the pH falls below 7, however, it may be assumed that it is not being controlled and large fractions of iodine as I_2 within the containment atmosphere may be produced.

18392 (WSRC-TR–91-624) **Effects of K-Reactor preoperational cold flow testing on total suspended solids in Pen Branch.** Wilde, E.W. Westinghouse Savannah River Co., Aiken, SC (United States). Dec 1991. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013365. Source: OSTI; NTIS; GPO Dep.

Total suspended solids (TSS) levels were monitored by SRL Environmental Sciences personnel at two locations in the Pen Branch Creek system in conjunction with K Reactor cold flow (pump) testing required as part of the reactor restart effort. The TSS data were compared with flow and rainfall data collected simultaneously in an effort to obtain insight on the suspension and movement for particulate material in the Pen Branch system in response to natural and operational causes. Pump testing clearly caused higher TSS levels at the two sampling locations. The artificially elevated TSS levels were more pronounced at a sampling location near the reactor than at a sampling location farther downstream. Although the environmental data provided by this study were obtained and used exclusively for process control and research purposes, rather than for formal regulatory compliance (i.e. NPDES monitoring), the TSS levels determined by the comprehensive testing were compared with NPDES limits required at various SRS outfalls. TSS values in Pen Branch were seldom in excess of these limits. Because of the relatively few times that TSS values at the two sampling locations exceeded "typical" NPDES limits, and the fact that occasional relatively high TSS values could clearly be solely attributed to rainfall, it was concluded that no major adverse environmental impacts were caused to the Pen Branch system as a result of the K-Reactor pre-operational pump testing.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 17906, 18342, 18354, 18411, 18415, 18416, 18418, 18421, 18423, 18424, 18431, 18560, 18561, 18562, 18567, 18568, 18569, 18570, 18574, 18575, 18576, 18577

18393 (CONF-920538--9) **Advanced Neutron Source reactor control and plant protection systems design.** Anderson, J.L. (Oak Ridge National Lab., TN (United States)); Battle, R.E.; March-Leuba, J.; Khayat, M.I. Oak Ridge National Lab., TN (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92011062. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the reactor control and plant protection systems' conceptual design of the Advanced Neutron Source (ANS). The Plant Instrumentation, Control, and Data Systems and the Reactor Instrumentation and Control System of the ANS are planned as an integrated digital system with a hierarchical, distributed control structure of qualified redundant subsystems and a hybrid digital/analog protection system to achieve the necessary fast response for critical parameters. Data networks transfer information between systems for control, display, and recording. Protection is accomplished by the rapid insertion of negative reactivity with control rods or other reactivity mechanisms to shut down the fission process and reduce heat generation in the fuel. The shutdown system is designed for high functional reliability by use of conservative design features and a high degree of redundance and independence to guard against single failures. Two independent reactivity control systems of different design principles are provided, and each system has multiple independent rods or subsystems to provide appropriate margin for malfunctions such as stuck rods or other single failures. Each system is capable of maintaining the reactor in a cold shutdown condition independently of the functioning of the other system. A highly reliable, redundant channel control system is used not only to achieve high availability of the reactor, but also to reduce challenges to the protection system by maintaining important plant parameters within appropriate limits. The control system has a number of contingency features to maintain acceptable, off-normal conditions in spite of limited control or plant component failures thereby further reducing protection system challenges.

18394 (CONF-920538--11) **The Advanced Neutron Source Thermal Hydraulic Test Loop.** Felde, D.K. (Oak Ridge National Lab., TN (United States)); Montgomery, B.H.; Yoder, G.L.; Skrzycke, D.P. Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92011105. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Neutron Source (ANS) Thermal Hydraulic Test Loop has been designed to provide known thermal-hydraulic conditions to a test section which simulates a full-length aluminum coolant subchannel of the ANS reactor core. Tests in this facility will provide both single- and two-phase thermal-hydraulic information. The specific phenomena that are to be examined are (1) single-phase heat transfer coefficients and friction factors, (2) the point of incipient boiling, (3) nucleate boiling heat transfer coefficients, (4) two-phase pressure drop characteristics in the nucleate boiling regime, (5) flow instability limits, and (6) critical heat flux limits. A Moyno "near" positive displacement type primary group with a 4 MPa differential head is capable of providing up to 35 m/s flow through the narrow channel test section. Two 12-volt dc power supplies, operated in parallel, with 40 kA total current capacity provide direct resistance heating to the test channel. A primary heat exchanger is designed to remove up to 410 kw. Data acquisition for the loop is through two PC-based systems, one of which is a fast data acquisition system capable of measuring up to 100,000 samples/s. As an aid in test design and analysis, an analytical model has been developed to predict the thermal hydraulic response of the test loop under transient conditions.

18395 (DPSP--57-1340) **Tritium in moderator.** Peoples, J.A. Jr. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 13 Nov 1957. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92011351. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Since the production of tritium in the moderator is of interest both from the Production and Health Physics aspects, it is desirable to be able to predict the tritium content of the process water. From a formula previously derived in DPSP-57-649 it has been shown that the production rate of tritium in the heavy water is a function of several reactor parameters, which in turn are dependent on the type of fuel and exposure. Since both the types of fuel and exposure vary from cycle to cycle in each reactor, a single formula for predicting tritium activity can only be approximate. This memorandum calculations of the tritium content in all the areas (R.P.L.K.C.) from initial start-up, to the present and compare these calculated values with the results obtained by laboratory analysis of the moderator. Also included in this report are reduced versions of the principle equation for various fuel loads and a set of empirical formulas yielding tritium activity as a function of total exposure (%).

18396 (DPSP--58-1918) **Reduction of dissolved radioactivities in moderator.** Longtin, F.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 29 Dec 1958. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92010942. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Programs are currently underway to increase working times around the reactor by reducing moderator turbidity and deposited activities. Since Na^{24} is a major contributor to area radiation levels, the possible gains from these programs cannot be fully realized without at the same time taking steps to reduce the Na^{24} radiation level after shutdown.

18397 (DPSP--59-391) **High initial corrosion of aluminum components.** Longtin, F.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 19 Jan 1959. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011348. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Corrosion of aluminum reactor components is high at nuclear start-up and/or several days thereafter. The high corrosion rate is manifested by high deuterium generation, high moderator conductivity and the appearance of turbidity in the moderator. A program is currently in progress to provide optimum protective coatings to the aluminum components before insertion into the reactors. This memorandum discusses factors, other than a protective coating, which may be associated with high aluminum corrosion just subsequent to reactor start-up.

18398 (DPSP--60-1816) **Acids for moderator pH control.** Longtin, F.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 10 Jan 1961. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. (RTR--270-R). Order Number DE92011346. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Use of nitric acid to control moderator pH requires presence of excess oxygen in the blanket gas to prevent radiolytic decomposition and loss of the acid. Excess oxygen is not desirable because it can possibly promote localized corrosion of stainless steel. The entire list of possible acids for use in pH control has been examined to find those meeting specifications. This document details this study.

18399 (DPSP--66-1367) **High flow vs TRE.** Longtin, F.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 11 Jul 1966. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (RTR--866). Order Number DE92010941. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A meeting was held on 6/7/66 to evaluate the relative merits of further increasing purification flow vs installing a turbidity removal evaporator in P or C Area. A comparison of the relative gains to be expected was given as an introduction to the subject. This memorandum is a record of that presentation.

18400 (HW–11715) **Water leak, 100-F Area.** Baker, J.T. Hanford Works, Richland, WA (United States). 1 Dec 1948. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012291. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document serves to record pertinent information regarding detection and repair of a water leak in Process Tube No. 3169-F in the F File and subsequent steps necessary to remove the water from the pile in order to return to normal level.

18401 (INIS-mf–13192, pp. 249) **Neutron flux densities in LVR reactor core.** Tomasek, F. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LR-0 REACTOR/neutron flux; NEUTRON FLUX/lr-0 reactor; FAST NEUTRONS; FLUX DENSITY; INTERMEDIATE NEUTRONS; THERMAL NEUTRONS

18402 (PNL–8010) **Modeling the behavior of a light-water production reactor target rod.** Sherwood, D.J. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012261. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory has been conducting a series of in-reactor experiments in the Idaho National Engineering Laboratory (INEL) Advanced Test Reactor (ATR) to determine the amount of tritium released by permeation from a target rod under neutron irradiation. The model discussed in this report was developed from first principles to model the behavior of the first target rod irradiated in the ATR. The model can be used to determine predictive relationships for the amount of tritium that permeates through the target rod cladding during irradiation. The model consists of terms and equations for tritium production, gettering, partial pressure, and permeation, all of which are described in this report. The model addressed only the condition of steady state and features only a single adjustable parameter. The target rod design for producing tritium in a light-water reactor was tested first in the WC-1 in-reactor experiment. During irradiation, tritium is generated in the target rod within the ceramic lithium target material. The target rod has been engineered to limit the release of tritium to the reactor coolant during normal operations. The engineered features are a nickel-plated Zircaloy-4 getter and a barrier coating on the cladding surfaces. The ceramic target is wrapped with the getter material and the resulting "pencils" are inserted into the barrier coated cladding. These features of the rod are described in the report, along with the release of tritium from the ceramic target. The steady-state model could be useful for the design procedure of target rod components.

18403 (WHC-SP–0450) **N Reactor graphite block inspections: Television camera surveillance in traverse holes.** Woodruff, E.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1989. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92013352. Source: OSTI; NTIS; INIS; GPO Dep.

Inspections of graphite block conditions in N Reactor traverse holes were converted from taped television recordings to a graphic format for overview perspectives and to survey structural details. Major observations include block breakage, filler block key breakage, and separations at breaks and junctions that have resulted from radiation induced contraction of the graphite blocks. Localized graphite oxidation appears in the top reflector near water leaks in subcritical neutron monitors that have since been repaired. Horizontal displacements to three inches are found near a central slip zone designed into the core by omission of selected tube block keys. The displacements correlate with similar displacements observed in Horizontal Control Rod Channels and are an indication that the rear sector of the core is decoupled from the front sector and has moved independently toward the rear in the manner governed by design. This separation stops near a top central traverse hole and does not propagate into the top reflector. Although considerable block damage appears in the central core, the condition seems to have stabilized and now served to distribute the effects of dimensional changes over a broad region preventing large localized displacements. The resulting small, dispersed displacements will not disrupt the function of safety ball channels and control rod channels. The findings document a benchmark for future surveillance on block conditions should reactor operations resume and will serve eventually as a database on core condition during decommissioning. 14 refs., 10 figs., 3 tabs.

18404 (WSRC-MS–90-195) **Materials experience and selection for nuclear materials production reactor heat exchangers.** Marra, J.E.; Louthan, M.R. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-901034–2: 1990 international joint power generation conference, Boston, MA (United States), 21-25 Oct 1990). Order Number DE92010682. Source: OSTI; NTIS; INIS; GPO Dep.

The primary coolant systems for the heavy-water nuclear materials production reactors at the Savannah River Site are coupled to the secondary coolant systems through shell and tube heat exchangers. The head, shell, and tube sheets of these heat exchangers are fabricated from AISI Type 304 grades of austenitic stainless steel. The 8,957 tubes in each heat exchanger were originally fabricated from Type 304 stainless steel, but service experience has lead to the use of Sea Cure tubing in newer systems. The design includes double tube sheets, core rods, and 33,410 square feet of heat transfer surface. Tubes are rolled into the tube sheets and seal welded after rolling. The tubes contain Type 304 stainless steel rods which are positioned in the center of each tube axis to increase the fraction of the cooling water contacting the heat transfer surface. Each reactor utilizes twelve heat exchangers; thus the 120+ reactor-years of operating experience provide approximately 1,440 heat exchanger-years of service. Fatigue, stress corrosion cracking, crevice corrosion, and pitting have been observed during the service life. This paper describes the observed degradation processes and uses the operational experience to recommend materials for the Heavy Water – New Production Reactor (HW-NPR).

18405 (WSRC-MS–91-269) **Acceptance criteria for heat exchanger head staybolts.** Sindelar, R.L.; Lam, P.S.; Barnes, D.M.; Placr, A.; Morrison, J.M. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920631–17: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92010633. Source: OSTI; NTIS; GPO Dep.

Each of the six primary coolant loop systems of the Savannah River Site production reactors contains two parallel single-pass heat exchangers to transfer heat from the primary coolant (D_2O) to the secondary cooling water (H_2O). The configuration of the heat exchangers includes a plenary space defined by the heat exchanger tubesheet and the heat exchanger head at both the heat exchanger inlet and outlet to the primary piping. The primary restraint of the heat exchanger head (Type 304 stainless steel) is provided by 84 staybolts (Type 303 stainless steel) which attach to the tubesheet. The staybolts were cap seal-welded in the mid-1960's and are immersed in moderator. Access to inspect the staybolts is limited to a recently-developed ultrasonic technique shooting a beam through the staybolt assembly. Acceptance Criteria to allow disposition of flaws detected by UT inspection have been developed. The structural adequacy to protect against collapse loading of the head is demonstrated by finite element analysis of the head assembly and fracture analysis of flaw postulates in the staybolts. Both normal operation and normal operation plus seismic loading conditions were considered. Several bounding cases containing various configurations of nonactive (exceeding critical flaw size) staybolts were analyzed. The model of the head assembly can be applied to evaluate any active staybolt configurations based on the results from future inspections. 9 refs.

18406 (WSRC-MS--91-406) **Inspection indications, stress corrosion cracks and repair of process piping in nuclear materials production reactors.** Louthan, M.R. Jr.; West, S.L.; Nelson, D.Z. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-911234--1: Conference on maintenance and repair welding in power plants, Orlando, FL (United States), 9-11 Dec 1991). Order Number DE92013115. Source: OSTI; NTIS; INIS; GPO Dep.

Ultrasonic inspection of Schedule 40 Type 304 stainless steel piping in the process water system of the Savannah River Site reactors has provided indications of discontinuities in less than 10% of the weld heat affected zones. Pipe sections containing significant indications are replaced with Type 304L components. Post removal metallurgical evaluation showed that the indications resulted from stress corrosion cracking in weld heat-affected zones and that the overall weld quality was excellent. The evaluation also revealed weld fusion zone discontinuities such as incomplete penetration, incomplete fusion, inclusions, underfill at weld roots and hot cracks. Service induced extension of these discontinuities was generally not significant although stress corrosion cracking in one weld fusion zone was noted. One set of UT indications was caused by metallurgical discontinuities at the fusion boundary of an extra weld. This extra weld, not apparent on the outer pipe surface, was slightly overlapping and approximately parallel to the weld being inspected. This extra weld was made during a pipe repair, probably associated with initial construction processes. The two nearly parallel welds made accurate assessment of the UT signal difficult. The implications of these observations to the inspection and repair of process water systems of nuclear reactors is discussed.

18407 (WSRC-MS--92-101) **Interim activities report.** Majzlik, E.H. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9203120--1: 33. weapons agencies nondestructive testing organization (WANTO) meeting, Livermore, CA (United States), 10-12 Mar 1992). Order Number DE92011155. Source: OSTI; NTIS; GPO Dep.

Several developments have occurred since the 32nd WANTO Meeting that effect the status of the Savannah River Site. A request to restart K-Reactor was issued after nearly three years of intensive engineering analysis, procedure revisions and enhanced operator training to upgrade all aspects of reactor operation. In early December 1991, the Westinghouse Savannah River Company requested permission from DOE to start the K-Reactor. In mid-December the DOE and the Defense Nuclear Facility Safety Board concurred with readiness to operate and a Federal Circuit Court of Appeals ruled against a lawsuit to delay restart until a cooling tower is completed. The K-Reactor was restarted and has been in an evaluation and testing mode. Full power operation at thirty percent of maximum capacity is projected for March 1992 after which actual tritium generation will begin. Operation will continue until October when the cooling tower will be tied into the reactor cooling system. In conjunction with the restart of K-Reactor, the P-Reactor has been placed in permanent shutdown status and the L-Reactor has been placed in warm stand-by. In another reactor related situation, the DOE will delay the decision on construction of the New Production Reactor (NPR) until 1993. The choice of reactor type and location of the NPR will be integrated into the overall programmatic decision on Reconfiguration of the Weapons Complex. Finally, construction of the Replacement Tritium Facility (RTF) was resumed in December 1991 after several months stoppage for evaluation and revision of project funding procedures.

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Refer also to citation(s) 18291, 18295, 18303, 18353, 18364, 18371, 18372, 18378, 18379, 18380, 18391, 18642, 19675, 20497, 20548

18408 (ANL/CP--75640) **Mechanical tests for validation of seismic isolation elastomer constitutive models.** Kulak, R.F.; Hughes, T.H. Argonne National Lab., IL (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920631--31: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92013051. Source: OSTI; NTIS; INIS; GPO Dep.

High damping laminated elastomeric bearings are becoming the preferred device for seismic isolation of large buildings and structures, such as nuclear power plants. The key component of these bearings is a filled natural rubber elastomer. This material exhibits nonlinear behavior within the normal design range. The material damping cannot be classified as either viscous or hysteritic, but it seems to fall somewhere in between. This paper describes a series of tests that can be used to characterize the mechanical response of these elastomers. The tests are designed to determine the behavior of the elastomer in the time scale of the earthquake, which is typically from 30 to 60 seconds. The test results provide data for use in determining the material parameters associated with nonlinear constitutive models. 4 refs.

18409 (ANL/CP--75716) **Technical specifications for the successful fabrication of laminated seismic isolation bearings.** Kulak, R.F. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9203135--1: Specialist meeting on seismic isolation technology, San Jose, CA (United States), 18-20 Mar 1992). Order Number DE92011845. Source: OSTI; NTIS; INIS; GPO Dep.

High damping laminated elastomeric bearings are becoming one of the preferred devices for isolating large buildings and structures. IN the United States, the current reference design for the Advanced Liquid Metal Reactor uses laminated bearings for seismic isolation. These bearing are constructed from alternating layers of rubber and steel plates. They are typically designed for shear strains between 50 to 100 percent and expected to sustain two to three times these levels for beyond design basis loading considerations. The technical specifications used to procure these bearings are an important factor in assuring that the bearings that are installed under nuclear structures meet the performance requirements of the design. The key aspects of the current version of the Technical Specifications are discussed in this paper.

18410 (ANL/CP--75769) **Analysis of a piping system for requalification.** Hsieh, B.J.; Tang, Yu. Argonne National Lab., IL (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920631--19: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92011844. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses the global stress analysis required for the seismic/structural requalification of a reactor secondary piping system in which minor defects (flaws) were discovered during a detailed inspection. The flaws in question consisted of weld imperfections. Specifically, it was necessary to establish that the stresses at the flawed sections did not exceed the allowables and that the fatigue life remained within acceptable limits. At the same time the piping system had to be qualified for higher earthquake loads than those used in the original design. To accomplish these objectives the nominal stress distributions in the piping system under the various loads (dead load, thermal load, wind load and seismic load) were determined. First a best estimate finite element model was developed and calculations were performed using the piping analysis modules of the ANSYS Computer Code. Parameter studies were then performed to assess the effect of physically reasonable variations in material, structural, and boundary condition characteristics. The nominal stresses and forces so determined, provided input for more detailed analyses of the flawed sections. Based on the reevaluation, the piping flaws were judged to be benign, i.e., the piping safety margins were acceptable inspite of the increased seismic demand. 13 refs.

18411 (BNL--47216) **Review of reports associated with systems of the K, P and L reactors at the Savannah River Site.** Cowgill, M.G. Brookhaven National Lab., Upton, NY (United States). Feb 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92013309. Source: OSTI; NTIS; INIS; GPO Dep.

Six reports associated with the structural integrity of several systems of the Savannah River Site reactors are reviewed. The focus is on the materials-related aspects of the reports and no attempt is made to address the stress analysis-related issues.

18412 (CONF-920375-10) **Aging and low-flow degradation of auxiliary feedwater pumps.** Adams, M.L. (Case Western Reserve Univ., Cleveland, OH (United States). Dept. of Mechanical and Aerospace Engineering). Oak Ridge National Lab., TN (United States). [1991]. 24p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92011070. Source: OSTI; NTIS; INIS; GPO Dep.

This paper documents the results of research done under the auspices of the Nuclear Regulatory Commission Nuclear Plant Aging Research Program. It examines the degradation imparted to safety Auxiliary Feedwater System pumps at nuclear plants due to the low flow operation. The Auxiliary Feedwater (AFW) System is normally a stand-by system. As such it is operated most often in the test mode. Since few plants are equipped with full flow test loops, most testing is accomplished at minimum flow conditions in pump by-pass lines. It is the vibration and hydraulic forces generated at low flow conditions that have been shown to be the major causes of AFW pump aging and degradation. The wear can be manifested in a number of ways, such as impeller or diffuser breakage, thrust bearing and/or balance device failure due to excessive loading, cavitation damage on such stage impellers, increase seal leakage or failure, sear injection piping failure, shaft or coupling breakage, and rotating element seizure.

18413 (CONF-920375-13) **Aging impact on the safety and operability of nuclear reactor pressure vessels.** Pennell, W.E. Oak Ridge National Lab., TN (United States). [1992]. 24p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92011789. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiation embrittlement causes a loss of reactor vessel material fracture toughness as nuclear plants age. Fracture mechanics based regulatory requirements limit the permissible level of irradiation embrittlement such that essential fracture prevention margins are maintained throughout the plant operating life. This paper reviews the regulatory requirements and the underlying fracture mechanics technology. Issues identified with that technology are identified and research programs implemented to resolve the issues are described. Where possible, an assessment is given of the anticipated impact on the research program output will have on the reactor vessel fracture-margin assessment process.

18414 (CONF-920375-14) **The application of probabilistic fracture analysis to residual life evaluation of embrittled reactor vessels.** Dickson, T.L. (Oak Ridge National Lab., TN (United States)); Simonen, F.A. Oak Ridge National Lab., TN (United States). [1992]. 14p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992. Order Number DE92013289. Source: OSTI; NTIS; INIS; GPO Dep.

Probabilistic fracture mechanics analysis is a major element of comprehensive probabilistic methodology on which current NRC regulatory requirements for pressurized water reactor vessel integrity evaluation are based. Computer codes such as OCA-P and VISA-II perform probabilistic fracture analyses to estimate the increase in vessel failure probability that occurs as the vessel material accumulates radiation damage over the operating life of the vessel. The results of such analyses, when compared with limits of acceptable failure probabilities, provide an estimation of the residual life of a vessel. Such codes can be applied to evaluate the potential benefits of plant-specific mitigating actions designed to reduce the probability of failure of a reactor vessel. 10 refs.

18415 (CONF-920538-10) **Thermal hydraulic response of the Advanced Neutron Source Reactor to piping breaks near the core region.** Chen, N.C.J.; Williams, P.T.; Yoder, G.L. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92011109. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the application of the RELAP5 thermal hydraulic code to a highly subcooled, plate type reactor typical of many research and production reactor systems. The specific system modeled is the latest design of the Advanced Neutron Source Reactor (ANSR). A discussion of the model as well as the results from several loss-of-coolant accident (LOCA) scenarios is included. The results indicate that this system responds to these accidents by a very rapid depressurization (over a few milliseconds) followed by a pressure recovery due to fluid inertia. In addition, the effect of including a gas pressurized accumulator in the system is addressed. The results show that tracking the pressure response of the system over these short time scales will be a key to accurately predicting the thermal response of the core of the reactor. Further, the break time scale as well as the time scale of the thermal response of the core, presently treated conservatively, will be additional important areas of study. 22 refs.

18416 (CONF-920538-13) **Dynamic simulation as an aid for the deisgn of the Advanced Neutron Source cooling system.** Khayat, M.I. (Tennessee Univ., Knoxville, TN (United States). Dept. of Nuclear Engineering); March-Leuba, J.; Maxon, B.D.; McNutt, G.R. Oak Ridge National Lab., TN (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92011678. Source: OSTI; NTIS; GPO Dep.

This paper presents a description of the conceptual design of the Advanced Neutron Source (ANS) cooling system and describes some dynamic simulations that were used to support this design. During the conceptual design stages of the ANS cooling system, the design team relied heavily on the result of dynamic simulations to discriminate between several options and select the one that appeared optimal. The ANS cooling system has been designed to perform not only during steady state full power and flow conditions but also during upset conditions such as loss of pumping power, loss of pressure conditions, loss of coolant, and loss of primary heat sink. By developing a dynamic model that analyzes and takes into account all these upset conditions during the early stages of the design, a cooling system capable of surviving all these events was developed. Based on these analyses, it was determined that loss of coolant accidents (LOCA) were the major contributors to core failure probability in the early ANS designs. Thus, a significant effort was devoted to improving the ANS performance under this type of accident scenarios. The resulting conceptual ANS cooling system has a number of features designed to minimize the consequences of LOCA events.

18417 (CONF-920538-22) **Towards intelligent automation of power plant design and operations: The role of interactive simulations and distributed expert systems.** Otaduy, P.J. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992. Order Number DE92013406. Source: OSTI; NTIS; INIS; GPO Dep.

The design process of a power plant can be viewed as machine-chromosome engineering: When the final layout is implemented, the lifetime operating characteristics, constraints, strengths, and weaknesses of the resulting power-plant-specimen are durably determined. Hence, the safety, operability, maneuverability, availability, maintenance requirements, and costs of a power plant are directly related to the goodness of its electromechanical-genes. This paper addresses the desirability of incorporating distributed computing, distributed object management, and multimedia technologies to power plant engineering, in particular, to design and operations. The promise these technologies have for enhancing the quality and amount of engineering knowledge available, concurrently, online, to plant designers, maintenance crews, and operators is put into perspective. The role that advanced interactive simulations and expert systems will play in the intelligent automation of power plant design and operations is discussed.

18418 (DOE/DP–0098T) **Emergency Diesel Generator reliability at Department of Energy (DOE) facilities.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Safety Diagnostic Div. Apr 1992. 45p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011888. Source: OSTI; NTIS; GPO Dep.

This report is the culmination of the first phase of a comprehensive effort by the Department of Energy (DOE) Defense Programs (DP) Office of Self-Assessment and Emergency Management (DP-9) to assess the reliability and availability of emergency power supplies (i.e., standby or backup supplies providing electric power to systems or equipment that perform functions important to safety) at DOE management concerns over the recent number of reported failures of emergency and back-up supplies to provide power when required. Augmented Evaluation Team (AET) on-site reviews were conducted during the week of September 30, 1991 at Rocky Flats (RF), and the week of October 7, 1991 at the Richland (RL) and Savannah River (SR) sites to investigate the failures. The AET reviews focused on Emergency Diesel Generator (EDG) failures because they were identified as the dominant contributor to power supply failures (46 of the 77 failures involved EDGs, as opposed to other sources such as batteries, motor-generator sets, etc.). The RF, RL, and SR sites were chosen because they were among the leaders in numbers of EDG failures. The objectives of the AET investigations were to collect, analyze, and document factual information concerning the causes, conditions, and circumstances surrounding EDG failures, to conduct a preliminary assessment of the safety significance of the failures and the site specific and generic safety implications for DOE facilities, and to identify appropriate follow-on actions necessary to complete the overall assessment of the adequacy of emergency and back-up power sources. This report presents the AET findings concerning the reliability of EDGs at the RF, RL, and SR sites, and the safety significance of EDG failures.

18419 (DOE/ID–10291) **Passive ALWR requirements to prevent containment failure: Advanced Reactor Severe Accident Program.** Additon, S.L. (TENERA, L.P., San Jose, CA (United States)); Blanchard, D.P.; Leaver, D.E.; Persinko, D. EG and G Idaho, Inc., Idaho Falls, ID (United States); TENERA, L.P., San Jose, CA (United States); TENERA, L.P., Bethesda, MD (United States). Dec 1991. 440p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (MISC–90120). Order Number DE92012356. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to document a systematic evaluation of the Passive Advanced Light Water Reactor (ALWR) design requirements which address severe accident mitigation. This evaluation was performed concurrent with completion of the ALWR Requirements Document to assure the adequacy of these mitigation requirements. The passive plant approach to containment integrity assurance reflects an expansion of the approach established earlier for evolutionary ALWRs. The report identifies containment challenges that might occur coincident with or result from a core damage event, compiles the set of passive ALWR design requirements which addresses each challenge, and evaluates each set of requirements on an integrated basis to confirm that the requirements provide substantial assurance that coincident core damage and containment failure are precluded. Based on past PRAs, a review of pertinent safety functions, severe accident analyses, current regulatory requirements, and reviews by ALWR design personnel, twenty-three (23) potential containment challenges were identified. The report concludes that the relevant ALWR requirements severe to limit the likelihood and magnitude of the challenges, and to assure the capability of the containment to accommodate all challenges which remain potentially risk-significant.

18420 (EGG-M–91372) **Modeling operator actions during a small break loss-of-coolant accident in a Babcock and Wilcox nuclear power plant.** Ghan, L.S.; Ortiz, M.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 12p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9111124–5: 1991 RELAP5/TRAC-B international users seminar, Baton Rouge, LA (United States), 4-8 Nov 1991). Order Number DE92011141. Source: OSTI; NTIS; INIS; GPO Dep.

A small break loss-of-accident (SBLOCA) in a typical Babcock and Wilcox (B&W) nuclear power plant was modeled using RELAP5/MOD3. This work was performed as part of the United States Regulatory Commission's (USNRC) Code, Scaling, Applicability and Uncertainty (CSAU) study. The break was initiated by severing one high pressure injection (HPI) line at the cold leg. Thus, the small break was further aggravated by reduced HPI flow. Comparisons between scoping runs with minimal operator action, and full operator action, clearly showed that the operator plays a key role in recovering the plant. Operator actions were modeled based on the emergency operating procedures (EOPs) and the Technical Bases Document for the EOPs. The sequence of operator actions modeled here is only one of several possibilities. Different sequences of operator actions are possible for a given accident because of the subjective decisions the operator must make when determining the status of the plant, hence, which branch of the EOP to follow. To assess the credibility of the modeled operator actions, these actions and results of the simulated accident scenario were presented to operator examiners who are familiar with B&W nuclear power plants. They agreed that, in general, the modeled operator actions conform to the requirements set forth in the EOPs and are therefore plausible. This paper presents the method for modeling the operator actions and discusses the simulated accident scenario from the viewpoint of operator actions.

18421 (EGG-NE–10078) **Statistically based uncertainty analysis for ranking of component importance in the thermal-hydraulic safety analysis of the Advanced Neutron Source Reactor.** Wilson, G.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012311. Source: OSTI; NTIS; INIS; GPO Dep.

The Analytic Hierarchy Process (AHP) has been used to help determine the importance of components and phenomena in thermal-hydraulic safety analyses of nuclear reactors. The AHP results are based, in part on expert opinion. Therefore, it is prudent to evaluate the uncertainty of the AHP ranks of importance. Prior applications have addressed uncertainty with experimental data comparisons and bounding sensitivity calculations. These methods work well when a sufficient experimental data base exists to justify the comparisons. However, in the case of limited or no experimental data the size of the uncertainty is normally made conservatively large. Accordingly, the author has taken another approach, that of performing a statistically based uncertainty analysis. The new work is based on prior evaluations of the importance of components and phenomena in the thermal-hydraulic safety analysis of the Advanced Neutron Source Reactor (ANSR), a new facility now in the design phase. The uncertainty during large break loss of coolant, and decay heat removal scenarios is estimated by assigning a probability distribution function (pdf) to the potential error in the initial expert estimates of pair-wise importance between the components. Using a Monte Carlo sampling technique, the error pdfs are propagated through the AHP software solutions to determine a pdf of uncertainty in the system wide importance of each component. To enhance the generality of the results, study of one other problem having different number of elements is reported, as are the effects of a larger assumed pdf error in the expert ranks. Validation of the Monte Carlo sample size and repeatability are also documented.

18422 (EGG-NE–10083) **Emissivity measurements in support of experiments on natural convection between a vertical cylinder and a surrounding array.** O'Brien, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012321. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental measurements of surface emissivities of three metallic samples have been obtained in support of an experiment aimed at determining natural convection and total heat transfer for a heated vertical cylinder surrounded by an array of cooled vertical tubes. In some cases, the heated stainless steel cylinder was shrouded by a perforated aluminum outer cylinder. The surrounding cooled tubes were also aluminum. In this experiment, heat transfer from the heated tube and the surrounding outer cylinder will occur by a combination of natural convection and radiation. At temperatures near the melting point of aluminum, the radiant contribution is particularly important, accounting for 50% or more of the total heat transfer. Consequently, accurate knowledge of surface emissivities of the heated rods, outer cylinders and surrounding structures is needed in order to predict the system thermal response during the transient. Direct measurements of surface emissivities have been obtained for one stainless steel and two aluminum samples. The measurements were obtained using an infrared pyrometer sensitive to the 8–14 μm wavelength range. A procedure for estimating total hemispherical emissivities based on the measured spectral, normal results is also provided.

18423 (EGG-PRP-10024) **Advanced Test Reactor probabilistic risk assessment methodology and results summary.** Eide, S.A.; Atkinson, S.A.; Thatcher, T.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012313. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Test Reactor (ATR) probabilistic risk assessment (PRA) Level 1 report documents a comprehensive and state-of-the-art study to establish and reduce the risk associated with operation of the ATR, expressed as a mean frequency of fuel damage. The ATR Level 1 PRA effort is unique and outstanding because of its consistent and state-of-the-art treatment of all facets of the risk study, its comprehensive and cost-effective risk reduction effort while the risk baseline was being established, and its thorough and comprehensive documentation. The PRA includes many improvements to the state-of-the-art, including the following: establishment of a comprehensive generic data base for component failures, treatment of initiating event frequencies given significant plant improvements in recent years, performance of efficient identification and screening of fire and flood events using code-assisted vital area analysis, identification and treatment of significant seismic-fire-flood-wind interactions, and modeling of large loss-of-coolant accidents (LOCAs) and experiment loop ruptures leading to direct damage of the ATR core. 18 refs.

18424 (EGG-SSRE-9625) **Firewater system inadvertent actuation frequency.** Schroeder, J.A.; Eide, S.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012362. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this analysis was to determine generic and plant-specific firewater inadvertent actuation frequencies for wetpipe and preaction firewater systems at the Advanced Test Reactor (ATR). Firewater systems of both kinds are installed throughout the ATR facility. When installed for the protection of reactor equipment, firewater systems may also adversely affect the equipment they are meant to protect. This occurs when inadvertent actuation of a firewater system causes wetting and subsequent damage to equipment.

18425 (JAERI-M-91-227) **Evaluation report on CCTF Core-II reflood Test C2-15 (Run 75): Investigation of FLECHT-SET coupling test results.** Okubo, Tsutomu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iguchi, Tadashi; Akimoto, Hajime; Murao, Yoshio. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1992. 99p. Order Number DE92514981. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents an evaluation on the CCTF Core-II Test C2-15 (Run 75). The purpose of the test is to investigate whether the thermo-hydrodynamic behavior is different between the CCTF and the FLECHT-SET reflooding tests. For this purpose, test conditions of the present test were set as close as possible to those of concerned FLECHT-SET 2714B experiment, taking account of differences in facility design. Investigating results of both the tests, the following conclusions are obtained: (1) Some discrepancies were observed in the measured test conditions between the two tests. Out of them, difference in the Acc injection duration was large and affected test results, such as the water accumulation in the downcomer and the core and the core cooling, during the initial period. However, this effect was found to become small with time. (2) Taking account of this difference and the difference in the broken cold leg pressure loss coefficient between the two facilities, the overall reflooding behavior is judged to be similar in the two facilities. (3) The CCTF test results showed the core heat transfer enhancement in the higher power region due to its steep radial power distribution, whereas the FLECHT-SET did not due to its rather flat radial power distribution. This enhancement was observed significantly at 1.83 m but was smaller at the higher elevation. (4) The heat transfer was nearly identical between the two tests and an existing correlation could well predict the heat transfer coefficients of both the tests at the location where the heat transfer enhancement mentioned above (3) were small, during the time period when the effect of the difference in the Acc injection mentioned above (1) were small. (5) Therefore, the core cooling is expected to be almost the same in the CCTF and the FLECHT-SET under the same core boundary conditions and core radial power distribution. (author).

18426 (JAERI-M-92-001) **Interaction between silver-indium-cadmium control-rod alloy and Zircaloy at high temperatures.** Nagase, Fumihisa (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Otomo, Takashi; Uetsuka, Hiroshi; Furuta, Teruo. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1992. 33p. (In Japanese). Order Number DE92514982. Source: OSTI; NTIS (US Sales Only); INIS.

In order to investigate the reactivity between control-rod (silver-indium-cadmium) alloy and Zircaloy during a severe accident of a pressurized water reactor, reaction couples of control-rod alloy and Zircaloy-4 were isothermally heated in argon at the temperatures ranging from 1273 to 1473K. The reaction rate increased with the temperature increase. About 1mm decrease in Zircaloy thickness was measured in the sample heated at 1473K for 60s. The reaction roughly obeyed a parabolic law, thereby the reaction rate constants and the apparent activation energy for the reaction, about 323kJ/mol, were determined. The microstructure and elemental distribution in reacted zones of samples was examined with an optical microscopy and an EPMA. (author).

18427 (Juel-2538) **Status report on the methodology of probabilistic safety analysis for HTR plants. Event sequences, system reliability, release frequencies.** Hennings, W. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik. Oct 1991. 45p. (In German). Order Number DE92511482. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the current status of the probabilistic methods and data for system analyses, reliability analyses and risk analyses of energy producing plants with high temperature graphite moderated reactors. This report is an update of the report Juel-Spez-388/vol.1 (May 1987), 'Methodik umfassender probabilistischer Sicherheitsanalysen fuer zukuenftige HTR-Anlagenkonzepte. Ein Statusbericht. Band 1: Ereignisablaeufe. Systemzuverlaessigkeiten, Freisetzungshaeufigkeiten'. (orig.).

18428 (Juel-2539) **Safety related studies on the accident behaviour of the HTR-100. Supplementary volume with detailed individual contributions on the Juel-Spez-477 report.** Wolters, J.; Mertens, J.; Altes, J.; Bongartz, R.; Breitbach, G.; David, P.H.; Degen, G.; Ehrlich, H.G.; Escherich, K.H.; Frank, E.; Hennings, W.; Jahn, W.; Koschmieder, R.; Marx, J.; Meister, G.; Moormann, R.; Rehm, W.; Verfondern, K. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik. Oct 1991. 388p. (In German). Order Number DE92511512. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of investigations was to verify the safety concept of the plant for balance and to quantify the radiological risk to be expected in operating an HTR-100 double unit system. Moreover, aspects of the investment risk were considered. The spectrum of initiating events ranged from so-called transients to leaks in the primary circuit and steam generator and even included earthquakes. Some of the event trees derived were highly complex and extensive due to the situation of the steam generator above the core and with regard to the double unit plant concept with increased possibilities of accident control, but also with respect to potential accident propagation. Correspondingly sophisticated analyses were required to identify risk-relevant event sequences. Environmental exposure for all risk-relevant accidents is so low that accident consequence calculations do not reveal any lethal radiation doses and practically no stochastic fatal injuries. These calculations neither assumed acute protective measures nor long-term resettlement or decontamination. The radiological risk caused by an HTR-100 plant is therefore to be classified as very low. The initiating events selected as representative and the event sequences studied in detail cover the risk-relevant event spectrum well into the hypothetical range. (orig./HP).

18429 (LA–12240) **MELCOR Peer Review.** Boyack, B.E. (Los Alamos National Lab., NM (United States)); Dhir, V.K.; Gieseke, J.A.; Haste, T.J.; Kenton, M.A.; Khatib-Rahbar, M.; Leonard, M.T. Los Alamos National Lab., NM (United States). Mar 1992. 280p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92012220. Source: OSTI; NTIS; INIS; GPO Dep.

MELCOR is a fully integrated, engineering-level computer code that models the progression of severe accidents in light water reactor nuclear power plants. The newest version of MELCOR is Version 1.8.1, July 1991. MELCOR development has reached the point that the United States Nuclear Regulatory Commission sponsored a broad technical review by recognized experts to determine or confirm the technical adequacy of the code for the serious and complex analyses it is expected to perform. For this purpose, an eight-member MELCOR Peer Review Committee was organized. The Committee has completed its review of the MELCOR code: the review process and findings of the MELCOR Peer Review Committee are documented in this report. The Committee has determined that recommendations in five areas are appropriate: (1) MELCOR numerics, (2) models missing from MELCOR Version 1.8.1, (3) existing MELCOR models needing revision, (4) the need for expanded MELCOR assessment, and (5) documentation.

18430 (LA-UR–91-209) **A phenomenological model of the thermal hydraulics of convective boiling during the quenching of hot rod bundles: Part 1, Thermal hydraulics model.** Nelson, R.A.; Unal, C. Los Alamos National Lab., NM (United States). [1991]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910739–6-Pt.1: 28. national heat transfer conference, Minneapolis, MN (United States), 26-31 Jul 1991). Order Number DE91007319. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, a phenomenological model of the thermal hydraulics of convective boiling in the post-critical-heat-flux (post-CHF) regime is developed and discussed. The model was implemented in the TRAC-PF1/MOD2 computer code (an advanced best-estimate computer program written for the analysis of pressurized water reactor systems). The model was built around the determination of flow regimes downstream of the quench front. The regimes were determined from the flow-regime map suggested by Ishii and his coworkers. Heat transfer in the transition boiling region was formulated as a position-dependent model. The propagation of the CHF point was strongly dependent on the length of the transition boiling region. Wall-to-fluid film boiling heat transfer was considered to consist of two components: first, a wall-to-vapor convective heat-transfer portion and, second, a wall-to-liquid heat transfer representing near-wall effects. Each contribution was considered separately in each of the inverted annular flow (IAF) regimes. The interfacial heat transfer was also formulated as flow-regime dependent. The interfacial drag coefficient model upstream of the CHF point was considered to be similar to flow through a roughened pipe. A free-stream contribution was calculated using Ishii's bubbly flow model for either fully developed subcooled or saturated nucleate boiling. For the drag in the smooth IAF region, a simple smooth-tube correlation for the interfacial friction factor was used. The drag coefficient for the rough-wavy IAF was formulated in the same way as for the smooth IAF model except that the roughness parameter was assumed to be proportional to liquid droplet diameter entrained from the wavy interface. The drag coefficient in the highly dispersed flow regime considered the combined effects of the liquid droplets within the channel and a liquid film on wet unheated walls. 431 refs., 6 figs., 4 tabs.

18431 (LA-UR–92-1086) **Final project report, TA-35 Los Alamos Power Reactor Experiment No. II (LAPRE II) decommissioning project.** Montoya, G.M. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920466–5: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92011230. Source: OSTI; NTIS; INIS; GPO Dep.

This final report addresses the decommissioning of the LAPRE II Reactor, safety enclosure, fuel reservoir tanks, emergency fuel recovery system, primary pump pit, secondary loop, associated piping, and the post-remediation activities. Post-remedial action measurements are also included. The cost of the project, including Phase I assessment and Phase II remediation was approximately $496K. The decommissioning operation produced 533 m^3 of low-level solid radioactive waste and 5 m^3 of mixed waste.

18432 (NUREG–0090-Vol.14-No.4) **Report to Congress on abnormal occurrences, October–December 1991: Volume 14, No. 4.** Nuclear Regulatory Commission, Washington, DC (United States). Office for Analysis and Evaluation of Operational Data. Mar 1992. 21p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence of an unscheduled incident or event that the Nuclear Regulatory Commission determines to be significant from the standpoint of public health and safety and requires a quarterly report of such events to be made to Congress. This report covers the period October through December 1991. Five abnormal occurrences at NRC-licensed facilities are discussed in this report. None of these occurrences involved a nuclear power plant. Four involved medical therapy misadministrations and one involved a medical diagnostic misadministration. The NRC's Agreement States reported three abnormal occurrences. Two involved exposures of non-radiation workers and one involved a medical therapy misadministration. The report also contains information that updates some previously reported abnormal occurrences.

18433 (NUREG–1125-Vol.13) **A compilation of reports of the Advisory Committee on Reactor Safeguards: 1991 annual: Volume 13.** Nuclear Regulatory Commission, Washington, DC (United States). Advisory Committee on Reactor Safeguards. Apr 1992. 138p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS.

This compilation contains 41 Advisory Committee on Reactor Safeguards (ACRS) reports submitted to the Commission, Executive Director for Operations, or to the Office of Nuclear Regulatory Research, during calendar year 1991. It also includes a report to the Congress on the NRC Safety Research Program. All reports have been made available to the public through the NRC Public Document Room and the US Library of Congress. The reports are divided into two groups: Part 1: ACRS Reports on Project Reviews, and Part 2: ACRS Reports on Generic Subjects. Part 1 contains ACRS reports alphabetized by project name and by chronological order within project name. Part 2 categorizes the reports by the most appropriate generic subject area and by chronological order within subject area.

18434 (NUREG–1266-Vol.6) **NRC safety research in support of regulation, FY 1991: Volume 6.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Apr 1992. 86p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report, the seventh in a series of annual reports, was prepared in response to congressional inquiries concerning how nuclear regulatory research is used. It summarizes the accomplishments of the Office of Nuclear Regulatory Research during FY 1991. The goal of this office is to ensure that safety-related research provides the technical bases for rulemaking and for related decisions in support of NRC licensing and inspection activities. This research is necessary to make certain that the regulations that are imposed on licensees provide an adequate margin of safety so as to protect the health and safety of the public. This report describes both the direct contributions to scientific and technical knowledge with regard to nuclear safety and their regulatory applications.

18435 (NUREG/CP–0118, pp. 1.1) **BWR lower plenum debris bed models for MELCOR.** Hodge, S.A. (Oak Ridge National Lab., TN (United States)); Hyman, C.R. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The coding developed within the BWRSAR code framework for calculating the behavior of a boiling water reactor (BWR) lower plenum debris bed after dryout and the associated vessel bottom head response is being made operational within the MELCOR code at Oak Ridge. After successful testing of these lower plenum debris bed and bottom head models within the structure of a local version of MELCOR, recommendations for formal adoption of these models will be made to the Nuclear Regulatory Commission and to the MELCOR code development staff at Sandia National Laboratories. The purpose of these models is to provide a means for calculating the time-dependent release of core and structural materials from the reactor vessel for accident sequences in which a dry debris bed is formed in the vessel lower plenum. Decay heating, energy release by zirconium oxidation, conduction, and radiative heat transport are represented within the bed as well as the effects of material melting, relocation, and freezing at a lower level. The melting and freezing processes include consideration of the formation of eutectic mixtures within the debris, as defined by user input.

18436 (NUREG/CP–0118, pp. 3.1) **Tests in the ATLE Loop on the PIUS design.** Babala, D. (ABB Atom AB, Vasteras (Sweden)); Bredolt, U.; Kemppainen, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The self-protective thermal hydraulic design of the primary system that prevents reactor power from exceeding the coolant capability of the submerging water independent of outside surveillance and supervision is a fundamental feature of the PIUS design. The experimental demonstration of the self-protective features of the primary system in a large scale test loop (the ATLE Loop) in the ABB Atom Engineering Laboratories are described in the paper. The volume scale of the ATLE Loop is approximately 1:300. The height of the test loop is the same as in the full scale design to ensure similarity in the driving buoyancy force during a transient. The test loop includes the following: one electrically heated, simulated fuel assembly, reactor pool, primary systems, upper and lower density locks and heat exchangers. System response to various severe transients and normal operations was studied. Comparisons were made with the predictions of the RIGEL code, which has been developed by ABB Atom specifically for study of the PIUS design and its predecessor designs. Selected results of these studies and comparison of these results with predictions obtained using RIGEL are presented in this paper.

18437 (NUREG/CP–0118, pp. 4.1) **CORA experiments on the materials behavior of LWR fuel rod bundles at high temperatures.** Hofmann, P. (Kernforschungszentrum Karlsruhe (West Germany)); Schanz, G.; Hagen, S.; Sepold, L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The chemical interactions that may occur in a fuel rod bundle with increasing temperature up to the complete melting of the components are described. The materials behavior of boiling water reactor (BWR) and pressurized water reactor (PWR) fuel rod bundles has been studied in integral experiments (CORA program) and extensive separate-effects tests. The kinetic results of the most important chemical interactions are represented. In most cases the reaction products have lower melting points or ranges than the original components. This results in a relocation of liquefied components, often far below their melting points. In addition, the influence of thin oxide layers, which form on Zircaloy surfaces during normal reactor operation on the chemical interactions is given. As a result of the various studies three distinct temperature regimes can be defined in which liquid phases form in the fuel rod bundles in different large quantities. Their influence on damage progression and on possible accident management measures to avoid an uncontrolled core melt down accident are described in detail.

18438 (NUREG/CP–0118, pp. 4.5) **DCH experiments in the CWTI facility.** Sharon, A. (Argonne National Lab., IL (United States)); Binder, J.L.; McUmber, L.M.; Baumgarten, I.; Spencer, B.W. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Nuclear Regulatory Commission (NRC) is sponsoring an experimental program investigating the Direct Containment Heating (DCH) issue in pressurized water reactors (PWRs). Integral Effect Tests (IET) are planned at Argonne National Laboratory (ANL) in the Corium Water Thermal Interaction (CWTI) facility at a nominal 1/30 linear scale to a reactor case. These tests are designed to be counterpart to the nominal 1/10 scale to be performed at Sandia National Laboratory (SNL). The main goal of the early tests is to identify scale distortions so as to better understand how to scale up the experimental data obtained in the program to a full scale plant. The initial DCH tests at ANL are planned to mock up the containment, cavity and the primary system of the Zion power plant. An accumulator with steam represents the scaled steam volume in the primary system. The accumulator is connected to a melt generator that contains corium simulant material. The melt is ejected out of the vessel into the cavity which is again a geometrically scaled model of the actual reactor cavity in the Zion plant. Entrained debris that exits the cavity enters the lower subcompartment at the bottom of a large expansion vessel. In these experiments the pressures, gas temperatures and hydrogen concentration in the different components are measured along with the debris dispersal, particle size distribution and oxidation. These results are compared to similar measurements at SNL to deduct scale distortions and provide predictions of a full scale containment to DCH. The paper summarizes the main experimental results of the tests and provides for some thoughts on the controlling phenomena and their scaling as deducted from the ANL results.

18439 (NUREG/CP–0118, pp. 4.9) **Results of recent NUPEC hydrogen related tests.** Takumi, K.; Nonaka, A.; Moriya, K.; Ogata, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Nuclear Power Engineering Center (NUPEC) started NUPEC Containment Integrity project entitled Proving Test on the Reliability for Reactor Containment Vessel in June, 1987. Based on the test results, computer codes are verified and as the result of analysis and evaluation by the computer codes, containment integrity is to be confirmed. This paper indicates the results of hydrogen mixing and distribution test and hydrogen burning test. A comparison of the NUPEC data with previously performed FITS test data at SNL is presented in terms of the peak combustion pressure normalized with respect to the initial pressure. The NUPEC data are in good agreement with the FITS data which were obtained at the lower hydrogen concentration condition. New data bases have been added in the higher hydrogen concentration by the NUPEC data.

18440 (NUREG/CP–0118, pp. 6.1) **Studies performed in support of the proposed revision of engineering design aspects of 10CFR100, Appendix A.** Witte, M. (Lawrence Livermore National Lab., CA (United States)); Prassinos, P.; Kenneally, R.;

Chokshi, N. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Part 100 of Title 10 of the Code of Federal Regulations (10CFR100) describes criteria which guide the commission in its evaluation of the suitability of proposed sites for nuclear power plants. Appendix A of this part describes seismic and geologic siting criteria for nuclear power plants. Some engineering design aspects of nuclear power plants are also briefly addressed in Appendix A. These include: definition of the operating basis earthquake (OBE) and the safe shutdown earthquake (SSE), definitions of safety related structures, systems and components, ratio of OBE to SSE, identification of acceptable analytical methods, and definition of vibratory ground motion. One of the interpretations of the regulations on the selection of the two earthquake design levels, the SSE and OBE, was that the SSE would control the design of all safety related systems while the OBE would be applied to the remaining systems required for continued power operation. In practice, however, with the load factors, damping, and service limits, the OBE, rather than the SSE, has controlled the design for some systems. The work in progress at Lawrence Livermore National Laboratory and at the Nuclear Regulatory Commission will develop the technical basis to support engineering related changes to Appendix A. Included in this effort are the following: investigation of the impact of removing the OBE from design considerations with regard to safety options and review of possible strategies regarding the definition and requirements of the OBE for future reactors. This paper reports on the status and results of studies performed to date in support of this project. These include a study to identify components that are important to plant safety and also are affected by OBE designs; a study to evaluate the impact on ASME BPVC Section 3 Division 1 of eliminating the OBE; and a study to evaluate the impact on design margins if the OBE is eliminated from design.

18441 (NUREG/CP–0118, pp. 6.3) **Enhancing the seismic margin review methodology to obtain risk insights.** Budnitz, R.J. (Future Resources Associates, Inc., Berkeley, CA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper discusses methods for obtaining risk insights from the seismic margin review (SMR) methodology. The SMR methodology was originally developed in 1984-1987 with the objective of analyzing an individual nuclear power plant to ascertain whether the plant has the ability to withstand earthquakes substantially beyond the design-basis earthquake without suffering a core-damage accident. Recently, in the context of Nuclear Regulatory Commission's (NRC's) Individual Plant Evaluation for External Events (IPEEE) program, the SMR methodology has been developed further by NRC to allow plants to identify plant-specific vulnerabilities (in the IPEEE sense) to seismic events. The objective of these enhancements has been to provide a methodology for IPEEE seismic review that is substantially less expensive than a full-scope seismic PRA, but that achieves the IPEEE's vulnerability-search objectives.

18442 (NUREG/CP–0118, pp. 6.5) **Model design for Large-Scale Seismic Test Program at Hualien, Taiwan.** Tang, H.T. (Electric Power Research Inst., Palo Alto, CA (United States)); Graves, H.L.; Chen, P.C. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Large-Scale Seismic Test (LSST) Program at Hualien, Taiwan, is a follow-on to the soil-structure interaction (SSI) experiments at Lotung, Taiwan. The planned SSI studies will be performed at a stiff soil site in Hualien, Taiwan, that historically has had slightly more destructive earthquakes in the past than Lotung. The LSST is a joint effort among many interested parties. Electric Power Research Institute (EPRI) and Taipower are the organizers of the program and have the lead in planning and managing the program. Other organizations participating in the LSST program are US Nuclear Regulatory Commission (NRC), the Central Research Institute of Electric Power Industry (CRIEPI), the Tokyo Electric Power Company (TEPCO), the Commissariat A L'Energie Atomique (CEA), Electricite de France (EdF) and Framatome. The LSST was initiated in January 1990, and is envisioned to be five years in duration. Based on the assumption of stiff soil and confirmed by soil boring and geophysical results the test model was designed to provide data needed for SSI studies covering: free-field input, nonlinear soil response, non-rigid body SSI, torsional response, kinematic interaction, spatial incoherency and other effects. Taipower had the lead in design of the test model and received significant input from other LSST members. Questions raised by LSST members were on embedment effects, model stiffness, base shear, and openings for equipment. This paper describes progress in site preparation, design and construction of the model and development of an instrumentation plan.

18443 (NUREG/CP–0118, pp. 7.11) **NRC test results and operations experience provide insights for new gate valve thrust equation.** Steele, R. (Idaho National Engineering Lab., Idaho Falls (United States)); DeWall, K.G.; Watkins, J.C. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Idaho National Engineering Laboratory (INEL) is performing motor-operated valve (MOV) research in support of the US Nuclear Regulatory Commission's (NRC's) efforts regarding Generic Issue 87, 'Failure of HPCI (High-Pressure Coolant Injection) Steam Line Without Isolation,' and Generic Letter 89-10 (GL 89-10), 'Safety-Related Motor-Operated Valve Testing and Surveillance.' This paper presents the results of testing to assess valve and motor operator performance under varying pressures and fluid conditions. This effort included an examination of the methods used by the industry for predicting required valve thrusts and research to provide guidelines for the extrapolation of in situ test results to design basis conditions. This research has identified several inconsistencies in the existing industry stem thrust equation and challenged the overly simplistic assumptions inherent in the use of the equation. This paper discusses development of a new equation whereby conservative stem thrust estimates can be calculated for some flexwedge gate valves, that is, those classes of valves whose operational characteristics have been shown to be predictable. The authors also present a method whereby the results of testing of such valves at low differential pressure can be used to estimate valve response at up to design basis conditions.

18444 (NUREG/CP–0118, pp. 8.1) **SBWR technology and development.** Rao, A.S. (General Electric Nuclear Energy, San Jose, CA (United States)); McCandless, R.J.; Sawyer, C.D. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The simplified boiling water reactor (SBWR) is based on utilizing to the maximum extent possible proven light water reactor (LWR) technology developed through 30 years of operating plant experience plus the advanced boiling water reactor (ABWR) technology development program. For the unique features, developmental programs have been put in place to qualify the design. Thus, the focus of technology development has been on the passive safety features - the gravity-driven ECCS (GDCS) and the containment heat removal (PCCS). General Electric constructed a full-height, scaled, integral facility to demonstrate the GDCS concept and provide data for methods qualification. For the PCCS, a three-pronged program was implemented. Basic heat transfer data were obtained via testing at the Massachusetts Institute of Technology and the University of California at Berkeley. A full-height scaled integral facility to demonstrate the PCCS concept and provide data for methods qualification was constructed in Japan in 1989. Initial testing is now complete. Design of a full-scale heat exchanger unit is underway and testing is planned for completion in early 1993.

18445 (NUREG/CP--0118, pp. 8.3) **Initial performance assessment of the Westinghouse AP600 containment design and related safety issues.** Nicolette, V.F. (Sandia National Labs., Albuquerque, NM (United States)); Washington, K.E.; Tills, J.L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This work summarizes the Westinghouse AP600 advanced reactor design assessment calculations performed to date with the CONTAIN code. Correlations for modeling the important heat transfer phenomena are discussed as well. A CONTAIN model of the AP600 was constructed for design basis accident (DBA) calculations. Insights gained from modeling of the smaller-scale Westinghouse Integral Test Facility were incorporated in the development of the AP600 model. The results of the DBA calculations are compared to the results of other researchers to serve as a point of reference for future severe accident calculations. The CONTAIN calculations are reviewed to examine several parameters/phenomena of interest. The results of the calculations are also used to identify limitations of the CONTAIN code regarding application to advanced reactor containment designs. The most recent heat transfer correlations available in the literature are assessed for use in the flow regimes and geometries applicable to the AP600. Use of one of these correlations in CONTAIN may allow for a more accurate assessment of the AP600.

18446 (NUREG/CP--0118, pp. 10.1) **Aging assessment of BWR control rod drive systems.** Greene, R.H. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This Phase 1 Nuclear Plant Aging Research (NPAR) study examines the aging phenomena associated with boiling water reactor (BWR) control rod drive mechanisms (CRDMs) and assesses the merits of various methods of managing this aging. Information for this study was acquired from (1) the results of a special CRDM aging questionnaire distributed to each US BWR utility, (2) a first-of-its-kind workshop held to discuss CRDM aging and maintenance concerns, (3) an analysis of NPRDS failure cases attributed to the CRD system, and (4) personal information exchange. As part of this study, nearly 3,500 NPRDS failure reports have been analyzed to examine the prevailing failure trends for CRD system components. An investigation has been conducted that summarizes the occurrence frequency of these component failures, discovery methods, reported failure causes, their respective symptoms, and actions taken by utilities to restore component and system service. The results of this research have identified the predominant CRDM failure modes and causes. In addition, recommendations are presented regarding specific actions that utilities can implement to mitigate CRDM aging. An evaluation has also been made of certain practices and tooling which have enabled some utilities to reduce ALARA exposures received from routine CRDM replacement and rebuilding activities.

18447 (NUREG/CP--0118, pp. 10.5) **An initial examination of aging related degradation in turbine drives and governors for safety related pumps.** Cox, D.F. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This study is being performed to examine the relationship between time dependent degradation, and current industry practices in the areas of maintenance, surveillance, and operation of steam turbine drives for safety related pumps. These pumps are located in the Auxiliary Feedwater (AFW) system for pressurized water reactor (PWR) plants, and the Reactor Core Isolation Cooling (RCIC) and High Pressure Coolant Injection (HPCI) systems for Boiling Water Reactor (BWR) facilities. This research has been conducted by examining current information in NPRDS, reviewing Licensee Event Reports, and thoroughly investigating contacts with operating plant personnel, and by personal observation. The reported information was reviewed to determine the cause of the event and the method of discovery. From this data attempts have been made at determining the predictability of events and possible preventive measures that may be implemented. Findings in a recent study on the Auxiliary Feedwater System (NUREG/CR-5404) indicate that the turbine drive is the single largest contributor to AFW system degradation. Recent improvements in maintenance practices and procedures, combined with a stabilization of the design seem to indicate that this equipment can be a reliable component in safety systems.

18448 (NUREG/CP--0118, pp. 11.7) **Development of guidelines for the validation and verification of expert systems.** Miller, L. (Science Applications International Corp., McLean, VA (United States)); Groundwater, E.; Mirsky, S. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Science Applications International has a joint contract with the NRC and the Electric Power Research Institute to develop guidelines for the verification and validation (V and V) of expert systems for use in the nuclear power industry. This paper reports on the overall goals and tasks of this ongoing multi-year contract. The authors highlight the key findings of the two task surveys completed so far: survey of the applicability of conventional V and V techniques to expert systems, and survey of activities and techniques actually used for V and V of expert systems. It is concluded with a discussion of the likely directions and emphases for the remaining work.

18449 (NUREG/CP--0118, pp. 12.1) **Most likely vessel lower head failure location during severe accident conditions.** Rempe, J.L. (Idaho National Engineering Lab., Idaho Falls (United States)); Chavez, S.A.; Snow, S.D.; Thinnes, G.L.; Allison, C.M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Nuclear Regulatory Commission is sponsoring a lower vessel head research program to investigate plausible modes of reactor vessel failure to determine: (a) which modes have the greatest likelihood of occurrence during a severe accident and (b) the range of core debris and accident conditions that lead to these failures. All major types of US light water reactor vessels are being considered, and both high- and low-pressure conditions are being addressed for each reactor type. The research program includes analytical and finite element calculations. In addition, high temperature creep and tensile data for predicting vessel structural response were obtained. Calculational results used to predict which failure location is more likely in a particular reactor design during a severe accident are described within this paper. Detailed analyses are being performed to investigate the relative likelihood of a BWR penetration and vessel to fail during a wide range of severe accident conditions. The analyses include applying a numerical model to obtain the penetration and vessel thermal response and applying an analytical model to investigate the relative likelihood of tube rupture and global vessel failure. Sensitivity studies considered the impact of assumptions related to debris composition, debris porosity, corium decay heat, vessel coolant mass, heat removal from the vessel, melt relocation time, and melt relocation distance on vessel and penetration response. In addition, analytically developed failure maps, which were developed in terms of dimensionless groups, are applied to extrapolate numerically-obtained results to geometries and materials occurring in PWR penetration/vessel configurations and a wide range of debris conditions.

18450 (NUREG/CP–0118, pp. 12.5) **On the prediction of steam explosion energetics.** Theofanous, T.G. (Univ. of California, Santa Barbara (United States)); Angelini, S.; Buckles, R.; Chen, X.; Yuen, W. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The primary purpose of this paper is to present recent results on certain key experimental aspects and mechanisms of steam explosions. In addition, sample results of integral calculations, incorporating the recent experimental results, are presented. The scope of this work is focused to the premixing and propagation phases of energetic explosions. On premixing, the authors present experimental results in scaled (1/8-scale) geometries of the lower plenum of a PWR. The computer code PM-ALPHA was used as the scaling tool to ensure the experiment is run under similar water depletion regimes as that predicted for the reactor. This water depletion (from the mixing zone) is the key physical mechanism that limits the energetics of such large scale explosions, and to a large extent these experiments are focused on it. Thus, instead of a molten material, hot solid particles are used in these experiments. Local, instantaneous liquid fraction measurements are made, within the three-phase mixing zone, by means of a new instrument developed specifically for this purpose. For calculating escalation and propagation, the key ingredient is the fuel fragmentation kinetics. These kinetics are explored experimentally in this work, for the first time, at conditions that simulate a propagating explosion. Finally, illustrative integral calculations are presented for large scale pours in the lower plenum.

18451 (NUREG/CP–0118, pp. 13.1) **Core-concrete interactions with overlying water pools.** Copus, E.R. (Sandia National Lab., Albuquerque, NM (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

One of the most important phenomenological issues in the progression of severe accidents after the reactor vessel has failed is whether or not the plant can be brought to a stable condition and the threat to containment integrity, whether by basemat penetration or by containment pressurization, is avoided. The most commonly available mechanism for removing heat from discharged melt in light water reactor (LWR) containments is water addition. The Dept. of Energy (DOE), industry, and the Nuclear Regulatory Commission (NRC) are all now working to develop and evaluate design criteria to address core debris coolability by water pools. One NRC element of this research is the WETCOR experimental program being performed at Sandia National Laboratories. These tests are intended to compliment and augment the Advanced Containment Experiments/Melt Attack and Coolability Experiments (ACE/MACE) program sponsored by Electric Power Research Institute (EPRI). Technically, the NRC approach will differ from the basic approach in the MACE tests by including heating of the experiment perimeter to reduce crust attachment and support. The WETCOR tests are also designed to answer two additional questions. These are: (1) is oxidic debris more or less coolable than metallic debris; (2) what are the limits of this coolability in terms of the debris depth, the debris power, and the debris composition? The WETCOR 1 test is being performed using a different oxidic debris type and under different boundary conditions than the MACE tests in order to focus on question number one. The remaining WETCOR tests will focus on conditions which will bound question number two. The results from the initial tests performed under the WETCOR program will be reviewed and compared to the initial MACE program results.

18452 (NUREG/CP–0118, pp. 13.3) **Parameter effects on molten debris spreading and coolability.** Moody, F.J. (General Electric Nuclear Energy, San Jose, CA (United States)); Fruth, K.M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The spreading, cooling, and freezing of molten core debris on a horizontal surface during a postulated severe accident are important considerations which influence the containment thermal response. Coolability of flowing debris is largely determined by its spreading configuration, as described by its time-dependent surface area and depth. If freezing occurs at the frontal edge of flowing debris, it may be sufficiently immobilized to prevent its contacting exposed containment boundaries. However, local mounding or piling up of debris could reach a depth at which decay and chemical heating cannot be removed by available cooling mechanisms, resulting in progressive, localized concrete degradation. An important aspect of molten debris spreading is its pattern as it emerges from the pedestal doorway in a Mark 1 containment. This study employs a special formulation with the method of characteristics, which provides an unsteady spreading pattern prior to arrival at a containment boundary. It was found that the spreading configuration depends on the volume flow rate, doorway width, and debris surface tension. Additional analyses provide simplified formulations to estimate: how far molten debris can spread before immobilization by freezing and subsequent mounding; the effect of gaseous void fraction; and the effect of metal/oxide stratification on the vertical temperature profile.

18453 (NUREG/CP–0118, pp. 14.1) **Source term update and decoupling siting from design - Summary and status.** Soffer, L. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Postulated fission product releases (so-called 'source terms') have played a major role in US regulatory requirements both for reactor siting and in setting plant design requirements. The current source term is derived from report TID-14844, issued in 1962, which postulates the instantaneous release into containment of 100% of the noble gas inventory of the core, 50% of the iodine fission products, and 1% of the remaining fission products. Current regulatory guidance also assumes that iodine is present primarily in the form of elemental iodine. At the present time, the Nuclear Regulatory Commission is pursuing several initiatives to incorporate research insights from severe accidents regarding source terms into regulatory guidance. The reactor site criteria (10 CFR 100) are to be revised to remove source term and dose calculations for siting purposes and to add exclusion area size and population density requirements directly into Part 100. An interim revision of 10 CFR 50 will be carried out in parallel to retain a reference to a source term. An updated report replacing TID-14844 is also in progress, and is expected to reflect changes in fission product timing, composition and magnitude, and iodine chemical form. A final revision of 10 CFR 50 to incorporate updated source term and severe accident research insights will then be undertaken. The present status of this effort and expected schedules are described in more detail in the paper.

18454 (NUREG/CP–0118, pp. 14.5) **Estimate of radionuclide release characteristics into containment under severe accident**

conditions. Nourbakhsh, H.P. (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Estimation of accident source term is important in nuclear safety regulation. Current regulations (10 CFR Part 100) requires that the suitability of the reactor site be judged based in part on a postulated fission product release associated with a substantial core-melt accident. The release into containment for this accident is derived from the 1962 Atomic Energy Commission report TID-14844 (Calculation of Distance Factors for Power and Test Reactor Sites). The use of TID-14844 release assumptions has not been confined to a determination of site suitability alone. The regulatory applications of releases of this type cover a wide range, including the basis for (1) performance of important fission-product clean-up systems such as sprays and filters, (2) post accident habitability requirements for the control room, (3) the radiation environment for safety related equipment qualification, (4) post-accident sampling systems and (5) containment leak rates. There has been significant research activity regarding severe accidents following the accident at Three Mile Island Unit 2 (TMI-2). A detailed review of the available source term information for light water reactors from this extensive research has been performed for the present study. This information is provided to support the generation of an updated estimate of source terms appearing in containment under severe accident conditions. A quantitative uncertainty analysis in the release into containment using NUREG-1150 methodology is also presented in this paper.

18455 (NUREG/CP–0118, pp. 14.7) **Calculation of fuel pin failure timings under LOCA conditions using FRAPCON-2, SCDAP/RELAP5/MOD3, TRAC-PF1, and FRAP-T6.** Jones, K.R. (Idaho National Engineering Lab., Idaho Falls (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A detailed analysis has been performed to calculate the timing of the containment isolation signals and the first fuel pin failure for loss of coolant accidents (LOCAs) of various sizes for a Westinghouse-4-loop design (Seabrook) and a Babcock and Wilcox design (Oconee). Sensitivity studies were performed to assess the impacts of fuel pin burnup, axial peaking factor, break size, emergency core cooling system (ECCS) availability, and main coolant pump trip on these timings. The analysis was performed using a four-code approach, comprised of FRAPCON-2, SCDAP/RELAP5/MOD3, TRAC-PF1, and FRAP-T6 calculations. In addition to the calculation of timing results, this analysis provides a comparison of the capabilities of SCDAP/RELAP5/MOD3 against FRAP-T6 and TRAC-PF1 for fuel pin failure analysis and large-break LOCA analysis, respectively. This paper discusses the methodology employed, the code development efforts required to implement the methodology, and the significant results obtained from this analysis.

18456 (NUREG/CP–0118, pp. 14.9) **NRC individual plant examination program overview - Summary and status.** Flack, J.H. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

On August 8, 1985, the Nuclear Regulatory Commission (NRC) issued a policy statement on severe accidents which concluded that existing plants posed no undue risk to public health and safety. The policy statement, however, recognized the importance of past probabilistic risk assessment (PRA) activities in understanding severe accidents at nuclear power plants, and in identifying previously unrecognized severe accident vulnerabilities. Based on this observation, the NRC issued Generic Letter 88-20 (and several supplements) which required licensees of commercial nuclear power plants to perform probabilistic safety assessments of their facilities. The assessments are to consider both internal initiated (termed Individual Plant Examination (IPE)), and external initiated (termed Individual Plant Examination for External Events (IPEEE)) events. Over the next few years, seventy-eight IPE/IPEEE submittals covering 114 nuclear units will be reviewed by the NRC staff. The review will focus on the process used by the licensee in fulfillment of the IPE and IPEEE objectives prescribed in Generic Letter 88-20. This paper provides an overview of the IPE review process and summarizes program status. In addition, a discussion of preliminary IPE/IPEEE findings and proposed licensee actions that result from their IPE effort are presented. These findings will be stored in a computerized data system to be used at a later date to gain generic insight into plant behavior for different classes of plants. Generic IPE/IPEEE insights should prove useful to the NRC staff in evaluating potential strengths and weaknesses of the regulations.

18457 (NUREG/CP–0118, pp. 17.1) **US accident management program.** Palla, R.L. Jr. (Nuclear Regulatory Commission, Washington, DC (United States)); Lauben, N. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The overall approach to accident management in the US and the status of key regulatory, research and industry activities are presented. Five general areas are identified for utility assessment and enhancement as part of accident management implementation: (1) strategies for managing events beyond the design basis, (2) severe accident training, (3) guidance and computational aids for technical support personnel, (4) information needs during severe accidents, and (5) structure and process for decision-making. Anticipated improvements and important technical issues in each of these areas are highlighted. US nuclear industry will play an important role in accident management by developing detailed guidance and information for use by utilities in implementing their accident management plans. The role of these products in the US program is outlined. A process and schedule for implementation is presented. A research program in support of accident management is an essential part of the Nuclear Regulatory Commission's activities and is also described.

18458 (NUREG/CP–0118, pp. 17.7) **U.S. nuclear industry approach to severe accident management guidance, development and implementation.** Modeen, D.; Walsh, L.; Oehlberg, R. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The purpose of this paper is to discuss the US nuclear industry activities, occurring under the auspices of Nuclear Management and Resources Council (NUMARC), to define, develop and implement enhancements to utility accident management capabilities. This effort consists of three major parts: (1) Development of a practical framework for evaluation of plant-specific accident management capabilities and the subsequent implementation of selected enhancements. (2) Development of specific technical guidance that address arresting core damage if it begins, either in-vessel or ex-vessel, and maintaining containment integrity. Preventing inadequate core cooling or minimizing the consequences of offsite releases, while considered to be candidate areas for accident management enhancements, have been the subject of intense previous study and development. (3) Plant-specific implementation of accident management enhancements in three areas: (a) personnel resources (organization, training, communications); (b) systems and equipment (restoration and repair, instrumentation, use of alternatives); and (c) information resources (procedures and guidance, technical information, process information).

18459 (NUREG/CP–0118, pp. 18.5) **Effects of hydrogen generation on severe accident natural circulation.** O'Brien, J.E. (Idaho National Engineering Lab., Idaho Falls (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

During certain pressurized water reactor (PWR) severe accident scenarios, natural circulation can play an important role in determining the failure location and time-to-failure of reactor coolant system (RCS) components. At the time in the transient when fuel cladding temperatures reach about 1,800 K, hydrogen generation due to the steam/zirconium reaction becomes significant. Effects of this hydrogen production on natural circulation flow and heat transfer have been considered in this report. Possible flow disruption due to hydrogen stratification in the reactor vessel and/or hydrogen-induced steam generator blockage were both considered. Long-term hydrogen stratification in the reactor vessel appears to be unlikely due to turbulent mixing associated with high Rayleigh number in-vessel natural convection. Mixing times scales were found to be very short, even when a fully stratified starting condition was assumed. This finding was consistent with experimental results obtained by Westinghouse with a 1/7-scale PWR RCS model.

18460 (NUREG/CP–0118, pp. 1.3-1.4) **The MELCOR peer review process and findings.** Boyack, B.E. (Los Alamos National Lab., NM (United States)); Dhir, V.K.; Haste, T.J.; Gieseke, J.A.; Viskanta, R.; Kenton, M.A.; Khatib-Rahbar, M.; Leonard, M.T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

MELCOR is a fully integrated, engineering-level computer code the models the progression of severe accidents in light water reactor nuclear power plants. MELCOR is being developed at Sandia National Laboratories for the US Nuclear Regulatory Commission (NRC) as a second-generation plant risk assessment tool and as the successor to the Source Term Code Package. MELCOR has been under development since 1982. The code has now reached sufficient maturity that a number of organizations inside and outside the NRC are using or are planning to use the code. Although the quality control and validation efforts are in progress, the NRC identified the need to have a broad technical review of recognized experts to determine or confirm the technical adequacy of the code for the serious and complex analyses it is expected to perform. A peer review committee was organized using recognized experts from the national laboratories, universities, MELCOR user community, and independent contractors to perform this assessment. The objective of this paper is to summarize the peer review process and to summarize the findings of the MELCOR Peer Review Committee formed to conduct the MELCOR peer review.

18461 (NUREG/CP–0118, pp. 1.5-1.6) **Planned MELCOR improvements and assessment.** Summers, R.M. (Sandia National Lab., Albuquerque, NM (United States)); Kmetyk, L.N. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

MELCOR is a fully integrated, engineering-level computer code that models the progression of severe accidents in light water reactor nuclear power plants. The entire spectrum of severe accident phenomena, including reactor coolant system and containment thermal-hydraulic response, core heatup, degradation and relocation, and fission product release and transport, is treated in MELCOR in a unified framework for both boiling water reactors and pressurized water reactors. MELCOR has been especially designed to facilitate sensitivity and uncertainty analyses. Its current uses include estimation of severe accident source terms and their sensitivities and uncertainties in a variety of applications. Version 1.8.1 of MELCOR, frozen in March 1991 and distributed in July, included several significant error corrections, improved numerics to increase computational efficiency, and improvements in input and out processing. MELCOR 1.8.1 has recently undergone a comprehensive technical review by recognized experts to determine the technical adequacy of the code for the serious and complex analyses it is expected to perform. One of the key findings of the peer review was the need for expanded MELCOR assessment. A comprehensive multi-year assessment plan has been developed and activities are underway to meet this need.

18462 (NUREG/CP–0118, pp. 1.7-1.8) **New containment modeling features of the CONTAIN code.** Murata, K.K. (Sandia National Labs., Albuquerque, NM (United States)); Williams, D.C.; Gido, R.G.; Griffith, R.O.; Washington, K.E.; Louie, D.Y.L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The CONTAIN code is the US Nuclear Regulatory Commission's (USNRC) best-estimate code for the integrated analysis of phenomena in reactor containments during severe accidents. While the most recent complete set of documentation applies to the CONTAIN 1.10 code version, two major revisions beyond CONTAIN 1.10 have recently been released. The purpose of this paper is to highlight the new features of the recent revisions, as well as discuss the new features that address containment issues either through new or significantly improved modeling or by providing the user with a means of conveniently assessing uncertainties for those modeling areas in which the phenomena are poorly understood. The recently released code versions are CONTAIN 1.11 and 1.12. The new features of CONTAIN 1.11 that are discussed here include (1) a quasi-mechanistic concrete outgassing model, (2) the connected structure option for heat transfer structures, and (3) a model for forced convective heat transfer. The recently revised outgassing model addresses a potentially important source of steam that could significantly affect pressures, the distribution of heat loads, and the steam inerting of hydrogen burns. The principal new feature of CONTAIN 1.12 is the direct containment heating (DCH) models. These models represent a major extension of code capabilities.

18463 (NUREG/CP–0118, pp. 10.3-10.4) **The effect of aging upon CE and B and W control rod drives.** Grove, E. (Brookhaven National Lab., Upton, NY (United States)); Gunther, W. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Though mechanically different, the control rod drive (CRD) systems used at both Combustion Engineering (CE) and Babcock and Wilcox (B and W) plants position the control rod assemblies (CRA) in the core in response to automatic or manual reactivity control signals. Both systems are also designed to provide a rapid insertion of the CRAs upon a loss of AC power. The CRD system consists of the actual drive mechanisms, power and control, rod position indication, and cooling system components. This aging evaluation included the individual absorber rods, and the fuel assembly and upper internal guide tubes, since failure of these components could preclude the insertion of the control assemblies. Aging and environmental degradation have resulted in system and component failures. Many of these failures caused dropped or slipped rods which adversely affected plant operations by resulting in power reductions, scrams, and safety system actuation. No CRD system failure has ever resulted in the inability to shut down a reactor. However, unplanned, automatic trips challenge the operation of the plants safety systems. Consequently, their occurrence represents a potentially significant increase in plant risk. System and component failures have resulted in four Information Notices during the past decade.

18464 (NUREG/CP–0118, pp. 10.7-10.8) **Aging, condition monitoring, and loss-of-coolant accident (LOCA) tests of Class 1E electrical cables: Summary of results.** Jacobus, M.J. (Sandia National Lab., Albuquerque, NM (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper summarizes the results of aging, condition monitoring, and accident testing of various nuclear power plant cable products. Four sets of cables were aged under simultaneous thermal (≃95C) and radiation (≃0.10 kGy/hr) conditions. One set of cables was aged for 3 months, a second set was aged for 6 months, a third set was aged for 9 months, and a fourth set was not aged. A sequential accident consisting of high dose rate irradiation (≃6 kGy/hr) and high temperature steam was then performed on each set of cables. The results of the tests indicate that the feasibility of life extension of some popular cable products is promising. Mechanical measurements, primarily elongation, modulus, and density, were more effective than electrical measurements for monitoring age-related degradation. The broad objectives of this experimental program were twofold: (a) to determine the life extension potential of popular cable products used in nuclear power plants and (b) to determine the potential of condition monitoring for residual life assessment.

18465 (NUREG/CP–0118, pp. 10.9-10.10) **Effects of aging on calibration and response time of nuclear plant pressure transmitters.** Hashemian, H.M. (Analysis and Measurement Services Corp., Knoxville, TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper presents the key results of an experimental research project conducted for the Nuclear Regulatory Commission to quantify the effects of normal aging on static and dynamic performance of nuclear grade pressure, level, and flow transmitters (hereafter referred to as pressure transmitters). The project involved laboratory testing of representative pressure transmitters manufactured by Barton, Foxboro, Rosemount, and Tobar (or Veritrak) companies. These manufacturers provide the four most commonly used pressure transmitters in the safety systems of US nuclear power plants. The transmitters were tested under normal aging conditions as opposed to accelerated aging, even though accelerated aging will be used in the last few months of the project to determine the weak links and failure modes of the transmitters. The project has been performed in two phases. The Phase 1 project which was a six month feasibility study has been completed and the results published in NUREG/CR-5383. The Phase 2 project is still underway with the final report due in the fall of 1991. The project has focused on the following areas: (1) effects of aging on calibration stability; (2) effects of aging on response time; (3) study of individual components of pressure transmitters that are sensitive to aging degradation; (4) sensing line blockages due to solidification of boron, formation of sludge, freezing, and other effects; (5) search of licensee event reports and component reliability databases for failures of safety-related pressure transmitters; and (6) oil loss syndrome in Rosemount pressure transmitters.

18466 (NUREG/CP–0118, pp. 10.11-10.12) **Applications of research results from NPAR service water system studies.** Jarrell, D.B. (Pacific Northwest Lab., Richland, WA (United States)); Stratton, R.C. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC06-76RL01830. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Under the Nuclear Plant Aging Research (NPAR) program, the Nuclear Regulatory Commission (NRC) has invested considerable resources in understanding the mechanisms, mitigating the damage, and managing the results of nuclear power plant aging degradation. Many direct benefits have resulted from this program in terms of improved plant safety through upgraded regulatory guidance. The 'Service Water System (SWS) Aging Degradation Assessment' (NUREG/CR-5379), produced by the Pacific Northwest Laboratory (PNL), contributed to this program. Two other benefits have resulted from the NPAR SWS task: (1) a contribution to the content of Generic Letter 89-13 (nuclear plant SWS performance requirements) and (2) the development of a systematic and complete root-cause analysis (RCA) methodology for use in the solution of SWS as well as other system component failures. Less recognized, but also of significance, are the spin-off initiatives from the NRC's NPAR program investigations. One such spin-off resulting specifically from the NRC-sponsored SWS research is the continuing development of the RCA methodology to facilitate the computerized integration of the following: (1) component condition monitoring; (2) fault diagnostics; and (3) failure root cause analysis. The Decision Support system for Operations and Maintenance project being developed at PNL is implementing the NPAR-developed RCA methodology utilizing an artificial intelligence approach.

18467 (NUREG/CP–0118, pp. 10.13-10.14) **Snubber aging assessment: Results of NPAR Phase 2 in-plant research.** Blahnik, D.E. (Pacific Northwest Lab., Richland, WA (United States)); Werry, E.V.; Brown, D.P. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Snubbers are safety-related devices used to restrain undesirable dynamic loads at various piping and large equipment locations in nuclear power plants. Each snubber must accommodate a plant's normal thermal movements and be capable of restraining the maximum off-normal dynamic loads postulated for its specific location. Snubbers are subject to the effects of aging, and the factors that degrade their safety performance need to be better understood. This paper describes the in-plant aging research conducted to enhance the understanding of snubber aging and its consequences. The research methodology, results, conclusions, and recommendations are described in the paper. Recommendations for monitoring the service life of snubbers are among the recommendations.

18468 (NUREG/CP–0118, pp. 11.1-11.2) **Overview of human factors issues associated with advanced passive reactors.** Persensky, J.J. (Nuclear Regulatory Commission Office of Nuclear Regulatory Research, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Nuclear power plant operators in current plants do just that, they operate the plant. They monitor the state of the process, observe trends, react to system changes and take action to maintain the plant in a safe condition. In order to accomplish these activities, they (1) rely on information available to them from the various instruments and displays in the control room, (2) use hard copy procedures to direct their actions and (3) perform their control actions through the various switches, keyboards and knobs available. Proposals from vendors and observations of activities in other countries indicate that the control room for advanced passive reactors is likely to be quite different from control rooms one would seen in current power plants. These differences will go beyond the immediate appearances, e.g., smaller, more cockpit-like, to issues of automation, function-allocation, the changing role of the operators and their training and qualifications, and software verification and validation. This research paper discusses some of these planned efforts and how they relate to the human factors issues and regulatory user needs.

18469 (NUREG/CP–0118, pp. 11.3-11.4) **Halden Reactor Project Workshop: Understanding Advanced Instrumentation and Controls Issues.** Beltracchi, L. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A Halden Reactor Project Workshop on 'Understanding Advanced Instrumentation and Controls Issues' was held in Halden, Norway, during June 17-18, 1991. The objectives of the workshop were to (1) identify and prioritize the types of technical information that the Halden Project can produce to facilitate the development of man-machine interface guidelines and (2) to identify methods to effectively integrate and disseminate this information to signatory organizations. As a member of the Halden Reactor Project, the Nuclear Regulatory Commission (NRC) requested the workshop. This request resulted from the NRC's need for human factors guidelines for the evaluation of advanced instrumentation and controls. The Halden Reactor Project is a cooperative agreement among several countries belonging to the Organization for Economic Cooperation and Development (OECD). The US began its association with the Halden Project in 1958 through the Atomic Energy Commission. The project's activities are centered at the Halden heavy-water reactor and its associated man-machine laboratory in Halden, Norway. The research program conducted at Halden consists of studies on fuel performance and computer-based man-machine interfaces.

18470 (NUREG/CP–0118, pp. 11.5-11.6) **Testing the deGroot recall paradigm to evaluate displays for operating personnel.** Moray, N. (Univ. of Illinois, Urbana (United States)); Jones, B.G.; Rasmussen, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

In this paper the authors report the results of experiments based on deGroot's work to assess the value of memory tests for measuring the quality of displays and the level of expertise of operators. Three kinds of display and people with three levels of expertise were included in the experiments. The displays were computer generated versions of traditional analog meters, traditional analog meters supplemented by a dynamic graphic representing the relation between temperature and pressure in some subsystems, and a dynamic graphic representing the underlying thermodynamics of power generation using the Rankine Cycle. The levels of expertise were represented by undergraduates with one semester of thermodynamics, graduate students of thermodynamics and nuclear engineering, and professional nuclear power plant operators. Each group watched a set of transients presented on the displays, using data generated by a high fidelity NPP training simulator, and were then asked three kinds of questions. The first measured their ability to recall the exact values of system state variables. The second measured their ability to recall what qualitative states the system had entered during the transient. The third measured their ability diagnose the nature of the transient. The results of the experiments are reported in relation to the possible use of memory tests to evaluate displays and the interaction of the quality of displays with the level of expertise of operators.

18471 (NUREG/CP–0118, pp. 11.9-11.10) **Guidelines for the review of advanced controls and displays.** Wachtel, J. (Nuclear Regulatory Commission, Washington, DC (United States)); O'Hara, J.M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Advanced control room (ACR) concepts are being developed and refined in the commercial nuclear industry as part of future reactor designs. These ACRs will utilize advanced human-system interface (HSI) technologies which may have significant implications for plant safety in that they may affect: (1) the operators' overall role (function) in the system; (2) the methods by which operators receive information about system status; (3) the ways in which the operators interact with the system; and (4) the requirements on operators to understand and supervise an increasingly complex system. The Nuclear Regulatory Commission (NRC) reviews control room designs to ensure that they incorporate good human factors engineering principles so as to support operator performance and reliability necessary to protect public health and safety. The principal guidance available to the NRC (NUREG-0700) was developed more than ten years ago and does not address new technologies. Accordingly, the guidance must be updated. This paper discusses the development of an NRC Advanced Control Room Design Review Guideline.

18472 (NUREG/CP–0118, pp. 12.3-12.4) **Cooling of core debris within the reactor vessel lower head.** Henry, R.E. (Fauske and Associates, Inc., Burr Ridge, IL (United States)); Burelbach, J.P.; Hammersley, R.J.; Henry, C.E.; Klopp, G.T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Under severe accident conditions, the most crucial action for recovery from the accident state is to cool the core debris and prevent or terminate attack on the remaining fission product barriers. One means of preventing attack on the containment structures is to retain the core debris within the reactor vessel. The TMI-2 accident demonstrated that this could be accomplished by water resident within the reactor vessel combined with injection on a continual basis to quench the debris and remove decay heat over the long term. Some accident situations could result in the transport of molten core debris to the lower plenum, as occurred in TMI-2, the boiloff of water in the lower plenum, and the inability to add water to the reactor coolant system (RCS). Even in this extreme set of circumstances, sufficient cooling may be available to prevent failure of the reactor pressure vessel (RPV) lower head and thereby retain the core debris within the vessel. Containment configurations like Zion would result in substantial accumulation of water around the lower parts of the reactor vessel for most accident sequences. For some PWR containments, there could be substantial water accumulation around the reactor vessel and the hot and cold legs. If this water could directly contact the carbon steel vessel surface and RCS piping, substantial energy could be removed from the primary system and in particular the RPV lower head. Experiments discussed in this paper demonstrate nucleate boiling heat removal rates from the outer surface of a simulated RPV lower head surrounded by typical reflective insulation used in nuclear power plants.

18473 (NUREG/CP–0118, pp. 12.7-12.8) **Recent development and results from severe accident research in Japan.** Soda, K. (Japan Atomic Energy Research Inst., Ibaraki (Japan)); Sugimoto, J.; Yamano, N.; Shiba, K. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

In recent years in Japan, severe accident research has been placed among the top-prioritized reactor safety researches since experimental and analytical investigations of a severe accident are needed to understand the safety margin of a nuclear power plant and to further improve accident management measures. It is thus indispensable to establish the knowledge base in the course of performing severe accident research and to utilize it for quantifying and reducing risks of a nuclear power plant. The Government's Annual Plan on Reactor Safety Research describes purposes of such severe accident research as: to identify phenomena associated with a severe accident, to develop analytical tools for source term analysis, to estimate a risk and safety margin of nuclear power plants, and to evaluate measures to prevent and mitigate severe accident by design and/or accident management. Severe accident research in Japan is pursued primarily at the Japan Atomic Energy Research Institute (JAERI) experimentally and analytically in accordance with the Annual Research Plan. In addition, demonstration tests at the Nuclear Power Engineering Test Center (NUPEC) are conducted with an emphasis on quantification of the safety margin of a nuclear power plant in conditions beyond the design basis. The summary of experimental and analytical investigations of severe accidents in Japan is briefly given.

18474 (NUREG/CP–0118, pp. 12.9-12.10) **Main safety issues related to IPSN severe accident research.** LeComte, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses IPSN/DPEI (France)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The work performed at IPSN concerning accident studies on nuclear installations is focused on the characterization of accidental sequences with three major aims: prevention, mitigation, and organization of counter-measures. As criteria to optimize all efforts made to improve nuclear safety, the radioactive dispersal in the environment must be quantified as function of internal and external radioactive products transfers. During the short-term phase of the accident, potential radioactive releases can be evaluated by the realistic code system ESCADRE. This system is validated by numerous analytical studies related to containment and fission product behavior. It will be further qualified by the results of the global experiments performed in the PHEBUS FP facility at IPSN.

18475 (NUREG/CP–0118, pp. 12.11-12.12) **SCDAP/RELAP5/MOD3 code development and assessment.** Allison, C.M. (Idaho National Engineering Lab., Idaho Falls (United States)); Heath, C.H.; Siefken, L.J.; Hohorst, J.K. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The SCDAP/RELAP5/MOD3 computer code is designed to describe the overall reactor coolant system (RCS) thermal-hydraulic response, core damage progression, and fission product release and transport during severe accidents. The code is being developed at the Idaho National Engineering Laboratory (INEL) under the primary sponsorship of the Office of Nuclear Regulatory Research of the Nuclear Regulatory Commission (NRC). SCDAP/RELAP5/MOD3, created in January, 1991, is the result of merging RELAP5/MOD3 with SCDAP and TRAP-MELT models from SCDAP/RELAP5/MOD2.5. The RELAP5 models calculate the overall RCS thermal-hydraulics, control system interactions, reactor kinetics, and the transport of noncondensible gases, fission products, and aerosols. The SCDAP models calculate the damage progression in the core structures, the formation, heatup, and melting of debris, and the creep rupture failure of the lower head and other RCS structures. The TRAP-MELT models calculate the deposition of fission products upon aerosols or structural surfaces; the formation, growth, or deposition of aerosols; and the evaporation of species from surfaces. The systematic assessment of modeling uncertainties in SCDAP/RELAP5 code is currently underway. This assessment includes (a) the evaluation of code-to-data comparisons using stand-alone SCDAP and SCDAP/RELAP5/MOD3, (b) the estimation of modeling and experimental uncertainties, and (c) the determination of the influence of those uncertainties on predicted severe accident behavior.

18476 (NUREG/CP–0118, pp. 13.5-13.6) **Analyses of corium spreading in Mark 1 containment geometry.** Sienicki, J.J. (Argonne National Lab., IL (United States)); Chu, C.C. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Under Nuclear Regulatory Commission (NRC) sponsorship, analyses have been performed of melt spreading and containment shell heatup following postulated reactor vessel failure in the Mark 1 system. The overall objectives of this work are to lend support to confirmation of the conservative assumptions made in the probabilistic assessment of Theofanous et.al. in NUREG/CR-5423 (1989), extend the results from that study, and thereby assist in resolution of the Mark 1 shell vulnerability issue. The approach consists mainly of calculations using the MELTSPREAD-1 computer code developed at Argonne National Laboratory under Electric Power Research Institute (EPRI) sponsorship as well as other supporting analyses. MELTSPREAD-1 models fluid dynamic and heat transfer processes involved in the transient spreading of core and structural materials over concrete or steel and submerged beneath water as well as the heatup of a structural boundary such as the containment steel shell. The mechanistic MELTSPREAD-1 calculations thus complement the simpler treatment of melt spreading incorporated in NUREG/CR-5423.

18477 (NUREG/CP–0118, pp. 13.7-13.8) **ACE program Phases C and D: Molten corium concrete interaction (MCCI) experiments and corium melt coolability experiments (MACE).** Sehgal, B.R. (Electric Power Research Inst., Palo Alto, CA (United States)); Spencer, B.W.; Thompson, D.H.; Fink, J.K.; Farmer, M.T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A series of experiments are being performed at Argonne National Laboratory (ANL) investigating the interaction of molten core material with concrete and its coolability with water. The work is supported by the ACE (Advanced Containment Experiments) International Consortium. This consortium consists of 19 countries; with the US participation shared by Nuclear Regulatory Commission (NRC), Department of Energy (DOE), Electric Power Research Institute (EPRI) and Westinghouse. The project is managed by EPRI. The general objectives of the molten core concrete interaction (MCCI) experiments are to measure: (1) the releases of refractory fission product species, i.e., oxides of lanthanum, barium, cesium and strontium; (2) the physical and chemical character of the aerosols generated; and (3) the thermal-hydraulic aspects of the interaction, including the concrete ablation rate. The principal objectives of the melt attack and coolability experiments (MACE) project are to: (1) obtain data on coolability with water of corium melt interacting with basemat concrete; and (2) develop models for insertion in the industry and NRC-sponsored codes.

18478 (NUREG/CP–0118, pp. 13.9-13.10) **Experimental results of an integral effects test with 1/10th scale Zion subcompartment structures in the Surtsey Test Facility.** Allen, M.D. (Sandia National Lab., Albuquerque, NM (United States)); Pilch, M.; Nichols, R.T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Surtsey Test Facility at Sandia National Laboratories (SNL) is used to perform scaled experiments for the Nuclear Regulatory Commission that simulate hypothetical high-pressure melt ejection (HPME) accidents in a nuclear power plant (NPP). These experiments are designed to investigate the phenomena associated with direct containment heating (DCH). High-temperature, chemically reactive melt is ejected by high-pressure steam into a 1:10 linear scale model of a reactor cavity. Debris is entrained by the steam blowdown into the Surtsey vessel, where specific phenomena, such as the effect of subcompartment structures, water in the cavity, and hydrogen generation, can be studied. The most recent Surtsey DCH experiment was the first of a series of Integral Effects Tests (IET-1) using a small scale model of the Zion Nuclear Generating Station. The purpose of this test series is to investigate possible scale distortions between NPP scale and experiment scale. The Surtsey DCH experiments will be conducted at 1:10 linear scale whereas counterpart tests will be performed at Argonne National Laboratory (ANL) at 1:40 scale. Results of these experiments will allow assessment of scaling methodologies proposed by the SASM-TPG and by SNL.

18479 (NUREG/CP–0118, pp. 14.3-14.4) **Iodine chemical forms in LWR severe accidents.** Beahm, E.C. (Oak Ridge National Lab., TN (United States)); Weber, C.F.; Kress, T.S. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The analyses in this study were based on quantitative (calculated) results of seven severe accident sequences for light water reactor (LWR) nuclear power plants. These sequences represent a wide range of conditions that are significant risks. Both high- and low-pressure sequences were chosen for three principal plant types; a single sequence was considered for the pressurized water reactor (PWR) ice condenser. Each sequence was evaluated by the Source Term Code Package (STCP), and the thermohydraulics has been documented in previous Nuclear Regulatory Commission (NRC) reports. The issue that has been addressed is the chemical forms of iodine in the reactor coolant system (RCS) and in containment - not the ultimate disposition of these chemical forms. In an LWR accident sequence, fission products released from the core will undergo changes in temperature and concentration as they pass through regions of the RCS. A chemical kinetic model used 20 reactions to determine the control volume where an equilibrium of the iodine, cesium, hydrogen, and steam species becomes frozen. This means that the temperatures and concentrations of species in subsequent control volumes are not sufficient to reach an equilibrium in the mean residence time available. The frozen equilibrium is the species distribution entering containment. Separate equilibrium calculations were performed, using the FACT system, to obtain the distribution of iodine species.

18480 (NUREG/CP–0118, pp. 14.11-14.12) **Safety goal implementation - Summary and status.** Hardin, B. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

During the past year, a special Nuclear Regulatory Commission (NRC) steering group has been preparing guidance for implementing the Commission's safety goal policy. The guidance is for interim use by the staff during a trial period to allow the staff to evaluate its effectiveness and to modify it as needed. At this time the guidance is limited to the consideration of safety goals in the regulation of operating plants only. The next step would be to extend its use to the licensing of the advanced reactor designs currently under review by the NRC.

18481 (NUREG/CP–0118, pp. 15.1-15.3) **Evidence for strong Holocene earthquake(s) in the Wabash Valley seismic zone.** Obermeier, S. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Many small and slightly damaging earthquakes have taken place in the region of the lower Wabash River Valley of Indiana and Illinois during the 200 years of historic record. Seismologists have long suspected the Wabash Valley seismic zone to be capable of producing earthquakes much stronger than the largest of record (m_b 5.8). The seismic zone contains the poorly defined Wabash Valley fault zone and also appears to contain other vaguely defined faults at depths from which the strongest earthquakes presently originate. Faults near the surface are generally covered with thick alluvium in lowlands and a veneer of loess in uplands, which make direct observations of faults difficult. Partly because of this difficulty, a search for paleoliquefaction features was begun in 1990. Conclusions of the study are as follows: (1) an earthquake much stronger than any historic earthquake struck the lower Wabash Valley between 1,500 and 7,500 years ago; (2) the epicentral region of the prehistoric strong earthquake was the Wabash Valley seismic zone; (3) apparent sites have been located where 1811-12 earthquake accelerations can be bracketed.

18482 (NUREG/CP–0118, pp. 15.5-15.6) **Paleoseismic investigations in the Northeastern and Southeastern United States: A status report.** Amick, D. (Ebasco Services Inc., Greensboro, NC (United States)); Gelinas, R.; Kemppinen, H.; Cato, K. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A systematic search for evidence of prehistoric earthquake activity along the Atlantic Seaboard found no conclusive paleoliquefaction evidence of large prehistoric earthquakes originating outside of South Carolina. In contrast, evidence of 6 large Holocene earthquakes has been found within the epicentral area of the 1886 Charleston earthquake. These findings support the hypothesis that during the past few thousand years earthquake induced ground motions have been strongest in the meizoseismal zone of the 1886 earthquake, and are in keeping with the concept of a unique seismotectonic setting near Charleston. The return period for these rare events was determined to be approximately 500 years. It is important to note that these past studies focused exclusively on coastal areas. As a logical extension the US Nuclear Regulatory Commission is presently funding neotectonic/paleoliquefaction studies in non-coastal areas of the South Carolina-Georgia Seismic Zone (SCGSZ), the Southern Appalachian Seismic Zone (SASZ), and at several locales in New England. Within the SCGSZ present paleoliquefaction investigations have targeted: (1) fluvial deposits near Union, SC; (2) lacustrine, fluvial and marine deposits near Bowman, SC; and (3) fluvial, lacustrine and marine deposits along the Coastal Plain segment of the Savannah River. Within the SASZ, the Giles County and eastern Tennessee seismicity clusters have been identified as high priority locales for future field investigations.

18483 (NUREG/CP–0118, pp. 15.7-15.8) **Ground amplification determined from borehole accelerograms.** Archuleta, R.J. (Univ. of California, Santa Barbara (United States)); Seale, S.H. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Garner Valley downhole array (GVDA) consists of one surface accelerometer and four downhole accelerometers at depths of 6 m, 15 m, 22m, and 220 m. The five, three-component vertical array of dual-gain accelerometers are capable of measuring accelerations from 3×10^{-6} g to 2.0 g over a frequency range from 0.0 Hz (0.025, high-gain) Hz to 100 Hz. The site (33° 41.60′ N, 116° 40.20°W) is only seven kilometers off the trace of the San Jacinto fault, the most active strand of the San Andreas fault system in southern California and only about 35 km from the San Andreas fault itself. Analysis of individual spectra and spectral ratios for the various depths shows that the zone of weathered granite has a pronounced effect on the spectral amplitudes for frequencies greater than 40 Hz. The soil layer impedance may amplify the high frequencies more than it attenuates. This result must be checked more thoroughly with special consideration of the spectra of the P-wave coda on the horizontal components. Analysis of the P-wave spectra and the spectral ratios shows an increased amplification in the same frequency range (60-90 Hz) where the S-wave spectral ratios imply a change in the attenuation. Comparison of acceleration spectra from two earthquakes, M_L 4.2 and M_L 2.5 that have nearly the same hypocenter, shows that the near surface amplification and attenuation is nearly the same for both earthquakes. However, the earthquakes themselves are different if we can assume that the recording at 220 m reflects the source spectra with a slight attenuation. The M_L 2.5 earthquake has significantly greater high frequency content if the spectra are normalized at the low frequency, i.e., normalization by seismic moment.

18484 (NUREG/CP–0118, pp. 15.9-15.10) **Temporal and spatial clustering of paleoseismic events along the Meers-Duncan-Criner fault zone: Implications to earthquake hazards in the Central and Eastern United States.** Swan, F.H. (Geomatrix Consultants, Inc., San Francisco, CA (United States)); Wesling, J.R.; Hanson, K.L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The northwest-striking Meers-Duncan-Criner fault zone lies along the complex northeastern border of the southern Oklahoma aulacogen, a fault-bounded trough that formed in the Middle Cambrian and extends into the craton from the southern margin of North America. The 200+ km-long fault zone separates a series of crustal uplifts on the southwest from very deep sedimentary basins to the northeast. The following characteristics of the Meers-Duncan-Criner fault zone may have significant implications to the assessment of earthquake hazards in the central and eastern US. Coincidence of this zone with the Oklahoma aulacogen suggests that the Quaternary faulting represents reactivation of a major zone of crustal weakness. During the late Quaternary the fault zone has been characterized by both temporal and spatial clustering of surface faulting events. This coupled with the absence of historical seismicity along the zone clearly demonstrates that the historical record is too short to identify some potentially hazardous seismic sources. Because of the potential for clustering of seismic events, low Quaternary slip rates do not a priori mean low seismic potential (i.e., small magnitude events and/or long recurrence intervals). Also, the small amount of cumulative displacement and the low slip rate relative to regional denudation rates can make it very difficult to detect Quaternary faulting along faults like the Meers-Duncan-Criner fault zone.

18485 (NUREG/CP–0118, pp. 15.11-15.12) **Modern and historic earthquake-induced liquefaction in the Saguenay-Laurentide region of Quebec.** Tuttle, M. (Lamont-Doherty Geological Observatory, Palisades, NY (United States)); Seeber, L.; Wolf, L.; Law, T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The 1988 Saguenay event of moment magnitude M_W 5.9 is the first modern earthquake in eastern North America for which liquefaction was documented and ground motion measured. It provides the opportunity to develop the usefulness of liquefaction features in paleoseismicity and to contribute to the assessment of the earthquake hazard in northeastern North America.

18486 (NUREG/CP–0118, pp. 15.13-15.14) **High-precision accelerator-mass-spectrometer radiocarbon dating of submerged tidal-marsh soils - An approach to estimating the frequency and coastal extent of subduction zone earthquakes in Oregon and Washington.** Nelson, A.R. (Geological Survey, Denver, CO (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Has subduction of the Juan de Fuca plate beneath the North America plate in the Pacific Northwest produced great (magnitude, $M > 8$) earthquakes during the late Holocene? Records of the past 200 years yield no evidence of great plate-boundary earthquakes in the Cascadia subduction zone. But along the coasts of Oregon and Washington peaty, tidal-wetland soils are interbedded with mud in estuarine stratigraphic sequences, and the submergence (relative rise of sea level) of some of these soils seems too widespread (> 100 km), too large (> 1 m), and too sudden (< 10 years) to be attributed to any process except coseismic subsidence. How large were the Cascadia plate-boundary earthquakes that produced coastal subsidence and how often did they occur? Such questions are critical for earthquake hazard assessment in the Pacific Northwest; radiocarbon dating of buried tidal-wetland soils can help answer these questions. The precision of age estimates for events in southern Oregon can be improved by averaging multiple accelerator-mass-spectrometer (AMS) ^{14}C analyses of rigorously selected and pretreated plant macrofossils at the abrupt upper contacts of tidal-marsh soils. An initial test of this method in South Slough shows that standard deviations on AMS ages can be reduced to ±25-40 years. However, consideration of the total analytical errors in AMS analysis and age differences due to changes in the rate of ^{14}C production in the atmosphere over time indicate that 95% confidence limits on calendar-corrected ages for submergence events range from 59 to 400 years.

18487 (NUREG/CP–0118, pp. 15.15-15.16) **Soil structure interactions of eastern U.S. type earthquakes.** Chang Chen (Gilbert/Commonwealth, Inc., Reading, PA (United States)); Serhan, S. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Two types of earthquakes have occurred in the eastern US in the past. One of them was the infrequent major events such as the 1811-1812 New Madrid Earthquakes, or the 1886 Charleston Earthquake. The other type was the frequent shallow earthquakes with high frequency, short duration and high accelerations. Two eastern US nuclear power plants, V.C Summer and Perry, went through extensive licensing effort to obtain fuel load licenses after this type of earthquake was recorded on sites and exceeded the design bases beyond 10 hertz region. This paper discusses the soil-structure interactions of the latter type of earthquakes.

18488 (NUREG/CP–0118, pp. 15.17-15.18) **A proposal for standardized seismic design (SSD) for nuclear power plants.** O'Hara, T.F.; Jacobson, J.P.; Briggs, W.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

US nuclear power plants (NPPs) are designed, engineered and constructed to exceptionally stringent standards. Their seismic adequacy is determined by regulatory compliance and demonstrated by probabilistic risk assessments (PRAs) and seismic margin studies. However, the present seismic siting criteria requires improvement. The goal of proposed changes to the siting criteria is a predictable licensing process and a stable regulatory environment. To satisfy this goal it is necessary to modify 10CFR100 Appendix A. At present NRC is scheduled to complete their redraft of Appendix A and supporting regulatory guides in 1991. Fundamental to the goal of stabilizing the licensing process is the removal of the interpretive details from Appendix A and placing them in regulatory guides. The authors acknowledge that the proposed simplification of the existing regulations should be accompanied by new regulatory guides which endorse acceptable methodologies in detail for deriving acceptable seismic design criteria for any site in question. This paper discusses one approach which could be endorsed in the proposed new regulatory guides. This proposed methodology evaluates EUS NPP seismic designs relative to their respective site seismic hazards to determine a generic probabilistic transfer function. Using this transfer function they propose a new means to determine acceptable seismic design levels based on hazard, the standardized seismic design.

18489 (NUREG/CP–0118, pp. 16.1-16.2) **Approach and results of the PWR low power and shutdown accident frequencies program - Coarse screening analysis for Surry.** Chu, T.L. (Brookhaven National Lab., Upton, NY (United States)); Musicki, Z.; Luckas, W.; Wong, S.M.; Fitzpatrick, R.G. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Traditionally, probabilistic risk analyses of severe accidents in nuclear power plants have limited themselves to consideration of the set of initiating events occurring during full power operation. However, some analyses of accident initiators during low power, shutdown, and other modes of plant operation other than full power have been performed. These studies as well as the Chernobyl accident and recent operating experience at US pressurized water reactors (PWRs) suggested that risks during low power and shutdown could be significant. As such, the analysis of the frequencies, consequences, and risks of these accidents was identified as one task in the Nuclear Regulatory Commission staff's study of the implications of the Chernobyl accident to US commercial nuclear power plants. This program is an ongoing high priority effort at Brookhaven National Laboratory (BNL). The scope includes a Level 1 probabilistic risk assessment (PRA) with internal fire and flood for Surry Unit 1 (PWR). This program is also closely coupled to a parallel project for the Grand Gulf plant (BWWR) being conducted by SNL. The program is being performed in two phases. Phase 1 represents a coarse screening analysis to identify dominant accident scenarios as well as risk dominant plant configurations and plant operating states. In Phase 2, a detailed PRA will be performed for the dominant accident scenarios/operating states identified in Phase 1. The objectives, results and insights of Phase 1 are discussed in the paper.

18490 (NUREG/CP–0118, pp. 16.3-16.4) **Status of the low power and shutdown accident sequence analysis project for the Grand Gulf Nuclear Power Station.** Whitehead, D.W. (Sandia National Lab., Albuquerque, NM (United States)); Staple, B.D.; Darby, J.; Walsh, B. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The purpose of this paper is to describe the work being conducted at Sandia National Laboratories (SNL) with regard to the identification and quantification of accident sequences initiated in modes of operation other than full power for the Grand Gulf Nuclear Power Station. As a result of the Chernobyl accident and other precursor events, the US Nuclear Regulatory Commission's Office of Nuclear Regulatory Research has undertaken a two-phase project to analyze the frequencies, consequences, and risk of accidents occurring during modes of operation other than full power. This paper presents a brief overview of Phase 1, which encompasses a coarse screening of potential accidents that could occur at Grand Gulf while operating at other than full power. This coarse screening approach was adopted as a means of obtaining, in a relatively short period of time, some estimation of the potential for accidents during low power and shutdown conditions and some idea of the magnitude of the work necessary to perform a more detailed analysis of these operating states. A companion project for a pressurized water reactor (PWR) was conducted by Brookhaven National Laboratory. After the Phase 1 results have been examined, a Phase 2 analysis will be performed. This phase will incorporate a detailed analysis of the plant for these modes of operation.

18491 (NUREG/CP–0118, pp. 16.5-16.6) **Integrated Level 3 risk assessment for the LaSalle Unit 2 nuclear power plant.** Payne, A.C. Jr. (Sandia National Lab., Albuquerque, NM (United States)); Brown, T.D.; Miller, L.A. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

An integrated Level 3 probabilistic risk assessment (PRA) was performed on the LaSalle County Station nuclear power plant using state-of-the-art PRA analysis techniques. The objective of this study was to provide an estimate of the risk to the offsite population during full power operation of the plant and to include a characterization of the uncertainties in the calculated risk values. Uncertainties were included in the accident frequency analysis, accident progression analysis, and the source term analysis. Only weather uncertainties were included in the consequence analysis. In this paper selected results from the accident frequency, accident progression, source term, consequence, and integrated risk analyses are discussed and the methods used to perform a fully integrated Level 3 PRA are examined. LaSalle County Station is a two-unit nuclear power plant located 55 miles southwest of Chicago, Illinois. Each unit utilizes a Mark 2 containment to house a General Electric 3323 MWt BWR-5 reactor. This PRA, which was performed on Unit 2, included internal as well as external events. External events that were propagated through the risk analysis included earthquakes, fires, and floods. The internal event accident scenarios included transients, transient-induced LOCAs (inadvertently stuck open relief valves), anticipated transients without scram, and loss of coolant accidents.

18492 (NUREG/CP–0118, pp. 16.7-16.8) **Risk-based performance indicators.** Azarm, M.A. (Brookhaven National Lab., Upton, NY (United States)); Vesely, W.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This research was sponsored by the Nuclear Regulatory Commission (NRC) to develop methods for monitoring an aspect of safety performance of licensed nuclear power plants; i.e., unavailability of safety systems. Various options were evaluated for constructing system unavailability indicators using basic reliability principles and consistent with the content of data collected. The capabilities of each indicator option, in terms of detection probabilities and false alarm rates within a fixed response period for various types of anomalies, were evaluated through detailed simulation studies. Brookhaven National Laboratory performed two studies to evaluate the capability of NPRDS (Nuclear Plant Reliability Data System) as a data source for construction of system unavailability indicators. Specific indicators were developed consistent with the limited scope of NPRDS data. In order to generate system unavailability indicators in an efficient manner, the processes for NPRDS data acquisition, indicator construction, and analyses were automated using PC software. Limited pilot applications and verification were also performed.

18493 (NUREG/CP–0118, pp. 16.9-16.10) **Inter-system LOCA risk assessment.** Galyean, W.J. (Idaho National Engineering Lab., Idaho Falls (United States)); Kelly, D.L.; Schroeder, J.A. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Inter-systems loss-of-coolant accidents (ISLOCAs) have been included in probabilistic risk assessments (PRAs) since WASH-1400. While estimated as being relatively low contributors to core damage frequency, ISLOCAs have been identified as major contributors to risk at nuclear power plants (NPPs). They have the potential to result in core melt and containment bypass, which may lead to the early release of large quantities of fission products. Recent events at several operating reactors have been identified as ISLOCA precursors. The occurrence of these events have raised concerns that the frequency of ISLOCA sequences might be underestimated in current state-of-the-art PRAs. In order to expand the current state-of-the-art, a Nuclear Regulatory Commission research program is being conducted by ED and G Idaho, Inc. at the Idaho National Engineering Laboratory. The objective of the ISLOCA research program is to generate qualitative and quantitative information on the hardware, human factors, and accident consequence issues that dominate nuclear power plant risks for ISLOCA. To meet this objective, the approach being taken includes analysis of all interfaces between the primary reactor coolant system and other, lower pressure systems. This historical experience (primarily, licensee event reports) has provided the basis for determining the scope of the analysis with respect to potential failure mechanisms of the pressure isolation boundary. It is important to note that in the vast majority of these events, the dominant failure was a human error. Because of their significance, human errors are given particular attention in the present analysis.

18494 (NUREG/CP–0118, pp. 17.3-17.4) **PWR instrument availability during severe accidents.** Arcieri, W.C. (Idaho National Engineering Lab., Idaho Falls (United States)); Hanson, D.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The ability of plant personnel to successfully manage severe accidents is strongly dependent on the availability of timely and accurate plant status information. The Nuclear Regulatory Commission (NRC) recognizes the importance of reliable plant information by making instrumentation an element of its accident management framework. This paper describes the results of research sponsored by the NRC to evaluate the availability of plant instrumentation for a range of possible severe accidents at a pressurized water reactor (PWR) with a large, dry containment using the approach developed in NUREG/CR-5513. Availability of plant instrumentation for a range of severe accidents is performed by: (1) identifying severe accidents that influence risk for a PWR with a large, dry containment, (2) defining the expected thermal hydraulic, radiation and humidity conditions affecting the instrumentation, and (3) assessing instrument availability based on location and conditions.

18495 (NUREG/CP–0118, pp. 17.5-17.6) **Managing water addition to a degraded core.** Kuan, P. (Idaho National Engineering Lab., Idaho Falls (United States)); Hanson, D.J.; Odar, F. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

In this paper the authors present an approach to the development of an accident management plan for adding water to a degraded core. Under certain degraded core conditions, adding water may lead to enhanced hydrogen production, changes in core geometry that would complicate recovery, steam explosions, or recriticality of the reactor core if unborated water is used. Therefore, a primary requisite for the development of an accident management plan for adding water to a degraded core is to ensure that undesirable consequences of water addition are understood so that: (1) their effects can be minimized and an accident can be terminated at the earliest possible stage, and (2) plant personnel can be better prepared to deal with plant responses that appear contrary to desired outcomes when water is added during a core degradation transient. The approach presented here addresses these concerns in the development of an accident management plan.

18496 (NUREG/CP–0118, pp. 17.9-17.10) **A structured approach to individual plant evaluation and accident management.** Klopp, G.T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The current requirements for the performance of individual plant evaluations (IPE's) include the derivation of accident management insights as and if they occur in the course of finalizing an IPE. The development of formal, structured accident management programs is, however, explicitly excluded from current IPE requirements. The Nuclear Regulatory Commission is following the Nuclear Management and Resources Council (NUMARC) efforts to establish the framework(s) for accident management program development and plants to issue requirements on such development at a later date. The Commonwealth Edison program consists of comprehensive level 2 PRA's which address the requirements for IPE's and which go beyond those requirements. From the start of the IPE efforts, it was firmly held, within Edison, that the best way to fully and economically extract a viable accident management program from an IPE was to integrate the two efforts from the start and include the accident management program development as a required IPE product.

18497 (NUREG/CP–0118, pp. 17.11-17.12) **A framework for assessing severe accident management strategies.** Kastenberg, W.E. (Univ. of California, Los Angeles (United States)); Apostolakis, G.; Dhir, V.K.; Okrent, D.; Jae, M.; Lim, H.; Milici, T.; Park, H.; Swider, J.; Xing, L.; Yu, D. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Accident management can be defined as the innovative use of existing and or alternative resources, systems and actions to prevent or mitigate a severe accident. Together with risk management (changes in plant operation and/or addition of equipment) and emergency planning (off-site actions), accident management provides an extension of the defense-in-depth safety philosophy for severe accidents. A significant number of probabilistic safety assessments (PSA) have been completed which yield the principal plant vulnerabilities. For each sequence/threat and each combination of strategy there may be several options available to the operator. Each strategy/option involves phenomenological and operational considerations regarding uncertainty. These considerations include uncertainty in key phenomena, uncertainty in operator behavior, uncertainty in system availability and behavior, and uncertainty in available information (i.e., instrumentation). The objective of this project is to develop a methodology for assessing severe accident management strategies given the key uncertainties mentioned above. Based on Decision Trees and Influence Diagrams, the methodology is currently being applied to two case studies: cavity flooding in a PWR to prevent vessel penetration or failure, and drywell flooding in a BWR to prevent containment failure.

18498 (NUREG/CP–0118, pp. 17.13) **Assessment of two BWR accident management strategies.** Hodge, S.A. (Oak Ridge National Lab., TN (United States)); Petek, M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A recently completed Oak Ridge effort proposes two management strategies for mitigation of the events that might occur in-vessel after the onset of significant core damage in a BWR severe accident. While the probability of such an accident is low, there may be effective yet inexpensive mitigation measures that could be implemented employing the existing plant equipment and requiring only additions to the plant emergency procedures. In this spirit, accident management strategies have been proposed for use of a borated solution for reactor vessel refill should control blade damage occur during a period of temporary core dryout and for containment flooding to maintain the core debris within the reactor vessel if injection systems cannot be restored. The proposed strategy for poisoning of the water used for vessel reflood should injection systems be restored after control blade damage has occurred has great promise, using only the existing plant equipment but employing a different chemical form for the boron poison. The dominant BWR severe accident sequence is Station Blackout and without means for mechanical stirring or heating of the storage tank, the question of being able to form the poisoned solution under accident conditions becomes of supreme importance. On the other hand, the proposed strategy for drywell flooding to cool the reactor vessel bottom head and prevent the core and structure debris from escaping to the drywell holds less promise. This strategy does, however, have potential for future plant designs in which passive methods might be employed to completely submerge the reactor vessel under severe accident conditions without the need for containment venting.

18499 (NUREG/CP–0118, pp. 18.1-18.2) **Analysis of decay heat removal following loss of RHR.** Naff, S.A. (Idaho National Engineering Lab., Idaho Falls (United States)); Ward, L.W. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Recent plant experience has included many events occurring during outages at pressurized water reactors. A recent example is the loss of residual heat removal system event that occurred March 20, 1990 at the Vogtle-1 plant following refueling. Plant conditions during outages differ markedly from those prevailing at normal full-power operation on which most past research has concentrated. Specifically, during outages the core power is low, the coolant system may be in a drained state with air or nitrogen present, and various reactor coolant system closures may be unsecured. With the residual heat removal system operating, the core decay heat is readily removed. However, if the residual heat removal system capability is lost and alternative heat removal means cannot be established, heat up of the coolant could lead to core coolant boil-off, fuel rod heat up, and core damage. A study was undertaken by the Nuclear Regulatory Commission to identify what information was needed to understand pressurized water reactor response to an extended loss of residual heat removal event during refueling and maintenance outages. By identifying the possible plant conditions and cooling methods that might be used, the controlling thermal-hydraulic processes and phenomena were identified. Controlling processes and phenomena include: gravity drain into the reactor coolant system, core water boil-off, and reflux condensation cooling processes.

18500 (NUREG/CP–0118, pp. 18.3-18.4) **A model for calculation of RCS pressure during reflux boiling under reduced inventory conditions and its assessment against PKL data.** Palmrose, D.E. (Idaho National Engineering Lab., Idaho Falls (United States)); Mandl, R. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Based on the occurrence of a number of plant incidents during low power and shutdown operating conditions, the Nuclear Regulatory Commission (NRC) has initiated several programs to better quantify risk during these periods. One specific issue of interest is the loss of residual heat removal (RHR) under reduced coolant inventory conditions. This issue is also of interest in the Federal Republic of Germany and an experiment was performed in the integral PKL-3 experimental facility at Siemens-KWU to supply applicable data. Recently, an effort has been undertaken at the Idaho National Engineering Laboratory (INEL) to identify and analyze the important thermal-hydraulic phenomena in pressurized water reactors following loss of vital AC power and consequent loss of the RHR system during reduced inventory operation. The thermal-hydraulic response of a nuclear steam supply system (NSSS) with a closed reactor coolant system (RCS) to loss of residual heat removal cooling capability is investigated in this report. The specific processes investigated include: boiling of the coolant in the core and reflux condensation in the steam generators, the corresponding pressure increase in the reactor coolant system, the heat transfer mechanisms on the primary and secondary sides of the steam generators, the effects of air or other noncondensible gas on the heat transfer processes, and void fraction distributions on the primary side of the system. Mathematical models of these physical processes were developed and validated against experimental data from the PKL 3B 4.5 Experiment.

18501 (NUREG/CP–0118, pp. 18.7-18.8) **Primary system thermal-hydraulics during the core uncovery phase of the TMI-2 accident.** Bessette, D. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

There is a question of where the primary system of a pressurized water reactor (PWR) will fail in a high pressure severe accident scenario. The core heatup process involves a race between whether the hot leg or surge line will fail from power operated relief valve (PORV) flows or buoyancy driven convection of heat or whether the lower head fails from melting and draining away of the core. The Three Mile Island Unit 2 (TMI-2) accident constitutes an important data point in reaching a determination. Any explanation or model of the process must not be inconsistent with what happened at TMI-2. There is, however, the question of 'What did happen at TMI?' Given that nearly half the core was molten, why were temperatures not experienced sufficient to melt upper plenum structures or fail the hot leg? The initial studies of TMI-2 concentrated on developing an overall description of the events that took place. Also, the studies were carried out prior to the identification of the issue of failure of the surge line or hot leg prior to vessel failure in a high pressure severe accident scenario. Subsequent analyses have been primarily aimed at characterizing the state of core damage and not the thermal hydraulics of the accident. The TMI-2 accident sequence must, therefore, be examined in terms of energy distribution during the period of core uncovery.

18502 (NUREG/CP–0118, pp. 18.9-18.10) **Scaling issues for a thermal-hydraulic integral test facility.** Shotkin, L. (Nuclear Regulatory Commission, Washington, DC (United States)); Boucher, T.; diMarzo, M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

As part of the design certification process for the new AP600 (advanced pressurized water reactor (PWR)) and simplified boiling water reactor (SBWR) reactors, the Nuclear Regulatory Commission (NRC) is evaluating the vendor testing programs, both separate effect and integral tests, to determine if any additional data would be desirable. Particular attention is being focused on integral testing of the interactions of these new passive safety systems under accident conditions. When considering an integral test facility for a new reactor, such as the AP600, a key question is the appropriate scaling rationale to use in its design. Scaling requirements are based on matching dimensionless parameters for both the model and the prototype. In 1987, Idaho National Engineering Laboratory (INEL) evaluated several scaling concepts for operating PWRs and concluded that most local phenomena would be captured using a full-height full-pressure, same working fluid scaling concept. Recently, INEL performed a similar study for the AP600. Five concepts (all of which would use the same working fluid as the AP600) were considered: FHFP (full height, full pressure); FHLP (full height, low pressure); RHRP (reduced height, reduced pressure); RHLP (reduced height, low pressure); and small-scale. A systematic process was followed in this evaluation and the results were independently reviewed. For the issues related to the AP600 design, the FHFP and FHLP options were the most cost effective. The specifics of full height scale may still be considered in light of the possible CCFL occurrences in the AP600 configuration. A reduced aspect ratio of the model may offer some advantages by better simulating the frictional versus gravitational force balance.

18503 (NUREG/CP-0118, pp. 18.11-18.12) **BWR stability analyses at BNL.** Wulff, W. (Brookhaven National Lab., Upton, NY (United States)); Cheng, H.S.; Rohatgi, U.S.; Mallen, A.N. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079-: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The March 9, 1988 instability at the LaSalle County-2 boiling water reactor power plant at Seneca, IL was simulated with Brookhaven National Laboratory's (BNL's) Engineering Plant Analyzer (EPA) for the purpose of demonstrating that the EPA is suitable for simulating large-amplitude, limit-cycle power and flow oscillations. It was shown in fall of 1988, by comparing all the available plant data from the STARTREC recording system of LaSalle-2 with EPA simulation results, that the EPA reproduces the LaSalle-2 oscillations without the use of stabilizing or destabilizing model or parameter modifications. The power vs. flow map of the LaSalle-2 plant was also reproduced at five lines of constant control rod positions. The LaSalle-2 stability boundary was established with the EPA and confirmed within ±15% accuracy by comparing the EPA results with the results of the frequency domain code LAPUR of Oak Ridge National Laboratory. Comparisons of EPA simulation results with plant data from three Peach Bottom stability tests show an agreement, based on mean and standard deviation, of $-10\pm28\%$, $-1\pm40\%$ and $+28\pm52\%$ (low power) in the gain of the pressure to power transfer functions. This demonstrates that the time domain code HIPA in the EPA is capable of simulating instabilities.

18504 (NUREG/CP-0118, pp. 18.13-18.14) **Small break LOCA RELAP5/MOD3 uncertainty quantification: Bias and uncertainty evaluation for important phenomena.** Ortiz, M.G. (Idaho National Engineering Lab., Idaho Falls (United States)); Ghan, L.S.; Vogl, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079-: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Nuclear Regulatory Commission (NRC) revised the Emergency Core Cooling System (ECCS) licensing rule to allow the use of Best Estimate (BE) computer codes, provided the uncertainty of the calculations are quantified and used in the licensing and regulation process. The NRC developed a generic methodology called Code Scaling, Applicability and Uncertainty (CSAU) to evaluate BE code uncertainties. The CSAU methodology was demonstrated with a specific application to a pressurized water reactor (PWR), experiencing a postulated large break loss-of-coolant accident (LBLOCA). The current work is part of an effort to adapt and demonstrate the CSAU methodology to a small break (SB) LOCA in a PWR of B and W design using RELAP5/MOD3 as the simulation tool. The subject of this paper is the Assessment and Ranging of Parameters (Element 2 of the CSAU methodology), which determines the contribution to uncertainty of specific models in the code.

18505 (NUREG/CP-0118, pp. 18.15-18.16) **Universal treatment of plumes and stresses for pressurized thermal shock evaluations.** Theofanous, T.G. (Univ. of California, Santa Barbara (United States)); Angelini, S.; Yan, H. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079-: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Thermally-induced stresses in a reactor pressure vessel wall, as a result of high-pressure safety injection, are an essential component of integrated risk analyses of pressurized thermal shock transients. Limiting cooldowns arise when this injection occurs under stagnated loop conditions which, in turn, correspond to a rather narrow range (in size) of small-break loss-of-coolant accidents. Moreover, at these conditions, the flow is thermally stratified, and in addition to the global cooldown, one must be concerned about the additional cooling potential due to the downcomer plumes formed by the cold streams pouring out of the cold legs. In the Nuclear Regulatory Commission's Integrated Pressurized Thermal Shock (IPTS) study, this stratification was calculated with the codes REMIX/NEWMIX. A comprehensive comparison with all available experimental data has currently been compiled. The stress analysis using this input was carried out at Oak Ridge National Laboratory using a one-dimensional approximation with the intent to conservatively bound the magnitude of thermal stresses.

18506 (NUREG/CP-0118, pp. 2.1-2.2) **Heavy-Section Steel Technology Program: Recent developments in crack initiation and arrest research.** Pennell, W.E. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079-: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Technology for the analysis of crack initiation and arrest is central to the reactor pressure vessel fracture-margin-assessment process. Regulatory procedures for nuclear plants utilize this technology to assure the retention of adequate fracture-prevention margins throughout the plant operating license period. As nuclear plants age and regulatory procedures dictate that fracture-margin assessments be performed, interest in the fracture-mechanics technology incorporated into those procedures has heightened. This has led to proposals from a number of sources for development and refinement of the underlying crack-initiation and arrest-analysis technology. An important element of the Heavy-Section Steel Technology (HSST) Program is devoted to the investigation and evaluation of these proposals. This paper presents the technological bases and fracture-margin assessment objectives for some of the recently proposed crack-initiation and arrest-technology developments. The HSST Program approach to the evaluation of the proposals is described and the results and conclusions obtained to date are presented.

18507 (NUREG/CP-0118, pp. 2.3-2.4) **Pipe fracture behavior under high-rate (seismic) loading - The IPIRG Program.** Schmidt, R.A. (Battelle, Columbus, OH (United States)); Wilkowski, G.M.; Scott, P.M.; Olson, R.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079-: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The International Piping Integrity Research Group (IPIRG) Program was an international group program managed by the USNRC and funded by a consortium of organizations from nine nations: Canada, France, Italy, Japan, Sweden, Switzerland, Taiwan, the United Kingdom, and the US. The five-year program was conducted at Battelle in Columbus, Ohio, and was completed in July 1991. The objective of the program was to develop data that are needed to verify engineering methods for assessing the integrity of nuclear power plant piping that contains circumferential defects. The program encompassed numerous tasks including material characterization studies, updates of a pipe fracture data base, seminars and workshops, and a leak-rate investigation that involves experiments, analysis, and computer code development, but the primary focus was an experimental task designed to investigate the behavior of circumferentially flawed piping and piping systems subjected to high rate loading typical of seismic events. The behavior of flawed piping and piping systems subjected to high rate loading was investigated by conducting both separate effects experiments on simple pipe specimens and full-scale experiments on a large-diameter piping system tested at PWR conditions. Key conclusions are noted.

18508 (NUREG/CP–0118, pp. 2.5-2.6) **Short cracks in piping and piping welds.** Wilkowski, G. (Battelle, Columbus, OH (United States)); Brust, F.; Francini, R.; Ghadiali, N.; Kilinski, T.; Krishnaswamy, P.; Landow, M.; Marschall, C.; Rahman, S.; Scott, P. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This program started on March 23, 1990, and has a duration of 4 years. The objective of the program is to develop and verify analyses by using existing and new experimental data for circumferentially cracked pipes, so modifications and improvements can be made to LBB and in-service flaw evaluation criteria. There are 7 technical tasks dealing, in general, with circumferentially cracked straight pipe under quasi-static loading. The tasks are as follows: short through wall cracked (TWC) pipe evaluations, short surface-cracked pipe evaluations, bi-metallic cracked pipe evaluations, dynamic strain aging and crack jump evaluations, anisotropic fracture evaluations, crack-opening-area evaluations, and NRCPIPE code improvements. There is also a separate task to develop international cooperation, interact with Section 11 of the ASME code, and perform program management functions.

18509 (NUREG/CP–0118, pp. 2.7-2.8) **Heavy-Section Steel Irradiation Program: Embrittlement issues.** Corwin, W.R. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Maintaining the integrity of the reactor pressure vessel (RPV) in a light-water-cooled nuclear power plant is crucial in preventing and controlling severe accidents and the potential for major contamination releases. It is imperative to understand and predict the capabilities and limitations of its integrity. It is particularly vital to fully understand the degree of irradiation-induced degradation of the RPV's fracture resistance which occurs during service, since without that radiation damage it is virtually impossible to postulate a realistic scenario which would result in RPV failure. The Heavy-Section Steel Irradiation (HSSI) Program has been established by the US Nuclear Regulatory Commission (USNRC) to provide a thorough, quantitative assessment of the effects of neutron irradiation on the material behavior, and in particular the fracture toughness properties, of typical pressure vessel steels as they relate to light-water reactor pressure-vessel integrity. Results from HSSI studies provide information needed to aid in resolving major regulatory issues facing the USNRC which involve RPV irradiation embrittlement such as pressurized-thermal shock, operating pressure-temperature limits, low-temperature overpressurization, and the specialized problems associated with low upper-shelf (LUS) welds. Taken together the results of these studies also provide guidance and bases for evaluating both the aging behavior and the potential for plant life extension of light-water RPVs. The principal materials examined within the HSSI program are high-copper welds since their postirradiation properties are most frequently limiting in the continued safe operation of commercial RPVs. Embrittlement modeling studies have shown that the time or dose required for the point defect concentrations, which ultimately contribute to irradiation embrittlement, to reach their steady state values can be comparable to the component lifetime or to the duration of an irradiation experiment.

18510 (NUREG/CP–0118, pp. 3.3-3.4) **Exploiting digital systems technology to improve nuclear safety.** Olmstead, R.A. (Atomic Energy of Canada Ltd., Montreal, Quebec (Canada)); Ichiyen, N.M.; Pauksens, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Nuclear plant designers in the 1990's have exceptional opportunities to exploit rapidly evolving computer and information system technology to make significant improvements in public safety. CANDU reactors have utilized extensive computer automation for reactor control for 20 years. A direct consequence is that the frequencies for forced outages and spurious protection system trips have been among the lowest for all reactor types. Historically, CANDU was among the first commercial power reactor to utilize computers to implement protection system. System functions with the PDC's (Programmable Digital Comparators) used in the CANDU 600 reactors. PDC's were used to implement the trip decision logic for the process trip parameters. The paper provides detail on safety benefits that have been realized from the use of digital automation for control and protection. The paper describes how accident risk reduction can be achieved in other ways with digital systems.

18511 (NUREG/CP–0118, pp. 3.5-3.6) **Analysis of postulated events for the revised ALMR/PRISM design.** Slovik, G.C. (Brookhaven National Lab., Upton, NY (United States)); Van Tuyle, G.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The PRISM reactor is presently under pre-application licensing review by the NRC, with Brookhaven National Laboratory (BNL) providing technical assistance. In this paper, the authors describe the latest set of results from their SSC and MINET code calculations. Series of postulated events were analyzed, for the most current PRISM design, to evaluate the system performance under unscrammed conditions. The PRISM reactor utilizes a metal fuel composed of 27% Pu, 10% Zr, and 63% U, based on the fuel developed by Argonne National Laboratory as part of the Integral Fast Reactor program. The fuel has a small power and temperature defect as a result of the high fuel thermal conductivity of metal and a hard neutron spectrum. The reactivity feedbacks of the core are designed to provide a negative response to off-normal, high temperature conditions, by invoking negative responses from the thermal expansion of the fuel, control rods, and core radial dimensions. The core restraint system incorporates the limited free bowing feature, which generates an outward bow of the in-core portion of the fuel assembly when a temperature gradient exits. The core also has three Gas Expansion Modules (GEMs) placed around the periphery, which will remove a combined worth of –69 cents of reactivity when the pumps are tripped from full power conditions. In evaluating this passive shutdown response, in which the PRISM reactor power should decrease significantly in response to overheated conditions, one considers three classes of unscrammed events. These include the unscrammed loss of flow (ULOF), loss of heat sink (ULOHS), and transient over power (UTOP) events.

18512 (NUREG/CP–0118, pp. 3.7-3.8) **Accident simulation and consequence analysis in support of MHTGR safety evaluations.** Ball, S.J. (Oak Ridge National Lab., TN (United States)); Wichner, R.P.; Smith, O.L.; Conklin, J.C.; Barthold, W.P. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991).

In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper summarizes research performed at Oak Ridge National Laboratory (ORNL) to assist the Nuclear Regulatory Commission (NRC) in preliminary determinations of licensability of the US Department of Energy (DOE) reference design of a standard modular high-temperature gas-cooled reactor (MHTGR). The work described includes independent analyses of core heatup and steam ingress accidents and the reviews and analyses of fuel performance and fission product transport technology.

18513 (NUREG/CP--0118, pp. 4.11-4.12) **Comparisons between HDR-H_2-distribution experiments E11.2 and E11.4.** Wolf, L. (Battelle-Europe, Frankfurt am Main (West Germany)); Valencia, L.; Wenzel, H.H.; Grimm, R.; Jansen, K. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The combination of issues important for the physical phenomena governing the H_2-mixing and distribution mechanisms in post-severe accident containment atmospheres, namely: large scale of the experimental facility, high H_2-release rates, superheated steam injection into the containment, multi-compartment geometry with sufficiently large dome volume representation, representative internal concrete and metal structures and surfaces, energy transfer across the containment steel shell into a very high annular ring space of 50 m height, multiple steam and H_2-injection phases, different axial positions for H_2-releases, examination of the efficiency of H_2-mitigating features including external dome, and spray as well as venting, has not been investigated yet in any experimental facility worldwide. The HDR with its subsystems has the features cited above. Therefore, Test Group E11 was designed and performed in 1989 to provide a first data set for severe accident containment atmospheres in close to real multi-compartment geometry. The test group consisted of the total of eight different experiments addressing a wide spectrum of H_2-distribution and mitigation issues. The paper focuses upon experiments E11.2 and E11.4 which both cover small break scenarios and a variety of mitigating measures.

18514 (NUREG/CP--0118, pp. 4.13-4.14) **Overview of Battelle-Europe experiments and model development on H_2-deflagrations, igniter and catalytic device verifications.** Wolf, L. (Battelle-Europe, Frankfurt am Main (West Germany)); Kanzleiter, T.; Behrens, U.; Langer, G.; Fischer, K.; Holzbauer, H.; Seidler, M.; Wolff, U. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The design and implementation of an optimal mitigation strategy against the potential threat by H_2-deflagrations/detonations in the aftermath of least probable severe accidents necessitates a knowledge base about these phenomena for representative conditions and realistic geometries. In order to extend existing know-how into the area of multi-compartment geometries connected by vents, the German Ministry of Research and Technology (BMFT) initiated in 1987 and fully sponsored since 1988 a multi-faceted experimental research program on H_2-deflagrations and related issues in multi-compartment geometries in the Battelle Model Containment (BMC). The following test groups constitute the Battelle-program: Test Group H: basic tests in H_2-air and H_2-steam air-mixtures; Test Group I: (sponsored by industry): supplemental tests in H_2-air and H_2-steam-air atmospheres; Test Group G: efficiency of H_2-mitigative measures such as igniters, catalyst modules and combinations thereof. Thus far, a total of 70 experiments have been performed and evaluated. The paper gives an overview of the Battelle-program by reviewing the examined geometries, bandwidths of tested H_2-concentrations, steam concentrations, ignition locations, specific atmospheric conditions (homogeneous, stratified) and other important parameters varied during and among the different test groups H, G, and I. Some experimental findings are reported.

18515 (NUREG/CP--0118, pp. 4.3-4.4) **Analysis of the EJET boiling jet mixing experiments using the integrated fuel-coolant interaction code, IFCI.** Rightley, M.J. (Sandia National Labs., Albuquerque, NM (United States)); Young, M.F.; Beck, D.F. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

In the event of a severe reactor accident leading to core melt, it is likely that molten fuel materials will come into contact with water, producing a molten fuel-coolant interaction (FCI). FCIs can occur for a variety of conditions in the core, the lower plenum, or in the reactor cavity. The nature of the FCIs that could occur ranges from benign static boiling, possibly including melt dispersion when the coherent melt mass is broken up on a time scale of 100's of milliseconds, to energetic steam explosions when the melt is finely fragmented on a time scale of milliseconds. Experimentation has revealed that scale-dependent processes occur in FCI's and that these dependencies are not understood. Attempts to model the process have generated several competing models. Unfortunately, the limited size and nature of the experimental database have made the choice of the correct model difficult. The integrated fuel-coolant interaction code, IFCI, was developed to provide a best estimate tool for FCIs, based on known physical laws and available experiments. The process of assessing the performance of IFCI involves comparing it to the different stages of FCI phenomena such as boiling jet breakup, detonation and products expansion. The NRC Program Molten Fuel-Coolant Interactions was initiated to perform this assessment against the current experimental data and other codes that have been developed to model FCIs. Upon completion of the assessment of the code, IFCI will be applied to reactor-scale simulations of lower plenum coarse mixing, steam and hydrogen production rates and steam explosion probabilities and their intensities.

18516 (NUREG/CP--0118, pp. 4.7-4.8) **Adiabatic equilibrium models for direct containment heating.** Pilch, M. (Sandia National Labs., Albuquerque, NM (United States)); Allen, M.D. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Probabilistic risk assessment (PRA) studies are being extended to include a wider spectrum of reactor plants than was considered in NUREG-1150. There is a need for simple direct containment heating (DCH) models that can be used for screening studies aimed at identifying potentially significant contributors to overall risk in individual nuclear power plants. This paper presents two adiabatic equilibrium models suitable for the task. The first, a single-cell model, places a true upper bound on DCH loads. This upper bound, however, often far exceeds reasonable expectations of containment loads based on CONTAIN calculations and experiment observations. In this paper, a two cell model is developed that captures the major mitigating feature of containment compartmentalization, thus providing more reasonable estimates of the containment load.

18517 (NUREG/CP--0118, pp. 5.1-5.2) **Annealing of Soviet VVER-440 reactor pressure vessels.** Serpan, C.Z. Jr. (Nuclear Regulatory Commission, Washington, DC (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Operators of VVER-440 pressurized water reactors in the Soviet Union and Eastern Europe have had to anneal a number of their pressure vessels in the recent past because the embrittlement has become too high. The continued operation of these plants was not considered allowable by regulatory authorities, so a vigorous research and development program was undertaken by the Soviets to determine the time and temperature criteria for annealing, to produce the equipment and hardware necessary for annealing, and to develop the in-plant procedures for its accomplishment. The Soviets have now accomplished ten annealings of reactor vessels in the Soviet Union, East Germany and Bulgaria. They have done the research necessary to understand the reasons why their steels embrittle so rapidly; they have determined that annealing at 460C for 100 to 150 hours will yield essentially 100% recovery, and that subsequent reembrittlement will occur at a rate no faster than the original rate (and possibly even at a slower rate than originally). Annealing of Soviet VVER-440 reactor vessels is now accomplished as a relatively routine operation. In principal there does not seem to be any insurmountable roadblock to use of annealing for embrittlement recovery of US reactor vessels in the future.

18518 (NUREG/CP--0118, pp. 5.11-5.12) **Progress in evaluation and improvement in nondestructive examination reliability for inservice inspection of light water reactors (LWRs) and characterizing fabrication flaws in reactor pressure vessels.** Doctor, S.R. (Pacific Northwest Lab., Richland, WA (United States)); Andersen, E.S.; Bowey, R.E.; Diaz, A.A.; Good, M.S.; Hockey, R.L.; Kurtz, R.J.; Schuster, G.J.; Simonen, F.A.; Spanner, J.C.; Taylor, T.T.; Vo, T.V. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC06-76RL01830. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper reports on progress achieved on two Nuclear Regulatory Commission (NRC) programs; the first program is entitled Evaluation and Improvement in Nondestructive Examination Reliability for Inservice Inspection of Light Water Reactors (LWRs) (NDE Reliability Program). This program consists of five major tasks as follows: (1) codes and standards activities, (2) pressure vessel inspection, (3) new inspection criteria, (4) field problem consulting, and (5) piping inspection. Activities conducted under these tasks are summarized. The NDE Reliability Program objectives are to quantify the effectiveness of inservice inspection (ISI) techniques for LWR primary system components through independent research and to establish means for improving the overall reliability of ISI systems and processes. Significant progress was achieved during the past year in several of these areas.

18519 (NUREG/CP--0118, pp. 5.13-5.14) **Validation and transfer of advanced NDE technologies.** Doctor, S.R. (Pacific Northwest Lab., Richland, WA (United States)); Bowey, R.E.; Hutton, P.H.; Kurtz, R.J.; Reid, L.D.; Schuster, G.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC06-76RL01830. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper reports on progress achieved under the Nuclear Regulatory Commission (NRC) program entitled Field Validation, Acceptance and Training for Advanced Nondestructive Testing (NDE) Technology. Work under this program in FY91 has concentrated on validation testing and the transfer of technologies previously developed under NRC supported programs. The objective of these efforts is to provide new beneficial NDE techniques which have been validated in their intended application mode on a reactor(s) and to transfer technologies to the nuclear industry. Program efforts are focused on acoustic emission (AE) for continuous monitoring and the synthetic aperture focusing technique for ultrasonic testing (SAFT-UT). These technologies will benefit nuclear plant regulation by providing timely indication of flaw initiation and growth as it occurs and the reliable detection of flaws with an accurate measure of the flaw size and shape.

18520 (NUREG/CP--0118, pp. 5.3-5.4) **Mechanisms and models of irradiation embrittlement of nuclear reactor structural steels.** Odette, G.R. (Univ. of California, Santa Barbara (United States)); Lucas, G.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The objective of this work is to develop a fundamental, physically based understanding of embrittlement phenomena which occur in pressure vessel and other structural steels used in nuclear power plants. The strategy is to use carefully selected experiments to guide the development and calibration of quantitative embrittlement models. These models aim to incorporate the separate and interactive effects on embrittlement of metallurgical (i.e., composition, microstructure, microchemistry, and the initial mechanical properties) and environmental (temperature, flux, fluence, spectrum and post irradiation annealing/reirradiation) variables. The physically based models will be used in statistical analysis of the surveillance data base to provide more accurate embrittlement predictions. Both experiments and modeling are facilitated by dividing embrittlement into three component processes: (1) the effect of the irradiation environment on microstructure; (2) the effect of microstructure on fundamental properties; and (3) the relationship between the fundamental properties and the various measures of fracture toughness. These component processes are integrated into composite models of embrittlement. The paper discusses models for transition temperature shifts measured in Charpy-v-notch impact tests.

18521 (NUREG/CP--0118, pp. 5.5-5.6) **Fatigue and environmentally assisted cracking in light water reactors.** Kassner, T.F. (Argonne National Lab., IL (United States)); Ruther, W.E.; Chung, H.M.; Hicks, P.D.; Park, J.Y.; Shack, W.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Fatigue and environmentally assisted cracking of piping and pressure vessels in light water reactors (LWRs) are important concerns as extended reactor lifetimes are envisaged. Another concern is failure of reactor-core internal components after accumulation of relatively high fluence, which has occurred in boiling water reactors (BWRs) and pressurized water reactors (PWRs). During this year the work in this program has addressed these concerns: fatigue of ferritic piping and pressure vessel steels, stress corrosion cracking of ferritic steels, effects of water chemistry on stress corrosion cracking of austenitic stainless steels, and irradiation-assisted stress corrosion cracking of Type 304 SS.

18522 (NUREG/CP--0118, pp. 5.7-5.8) **Estimation of mechanical properties of cast stainless steels during thermal aging in LWR systems.** Chopra, O.K. (Argonne National Lab., IL (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

A program is being conducted to investigate the thermal embrittlement of cast duplex stainless steels under light water reactor (LWR) operating conditions and to evaluate possible remedies for the embrittlement problem in existing and future plants. The scope of the investigation includes several goals: (1) develop a methodology and correlations for predicting the toughness loss suffered by cast stainless steel components during normal and extended life of LWRs, (2) establish the mechanism of aging and validate the simulation of in-reactor degradation by accelerated aging, and (3) establish the effects of key compositional and metallurgical variables on the kinetics and extent of embrittlement. A procedure and correlations are presented for predicting mechanical properties of cast stainless steel components during thermal aging in LWRs at 280-330C (535-625F). These correlations are updates of those presented at the last meeting. Extent of thermal embrittlement as a function of time and temperature of reactor service is then estimated from the extent of embrittlement at saturation and from the correlations describing the kinetics of embrittlement, which are given in terms of chemical composition and the aging behavior at 400C.

18523 (NUREG/CP–0118, pp. 5.9-5.10) **Mechanical-property degradation of cast stainless steel components from the Shippingport reactor.** Chopra, O.K. (Argonne National Lab., IL (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Cast duplex stainless steels used in LWR systems for primary pressure-boundary components such as valve bodies, pump casings, and primary coolant piping are susceptible to thermal embrittlement after extended service at reactor operating temperatures, i.e., 280-320C. Aging of cast stainless steels at these temperatures causes an increase in hardness and tensile strength and a decrease in ductility, impact strength, and fracture toughness. Most studies pertaining to thermal embrittlement of cast stainless steels involve simulation of end-of-life reactor conditions by accelerated aging at higher temperatures, viz., 400C, because the time period for operation of power plants is far longer than can generally be considered for laboratory studies. Thus, estimates of the loss of fracture toughness suffered by cast stainless steel components are based on an Arrhenius extrapolation of high-temperature data to reactor operating conditions. Several laboratory studies have been conducted to investigate thermal embrittlement of cast stainless steels under LWR operating conditions. A procedure and correlations have been developed for estimating the fracture toughness, tensile, and Charpy-impact properties of cast stainless steel components during thermal aging. In view of the complexity of the embrittlement mechanisms and kinetics, there has been a need for microstructural studies and mechanical testing of actual component materials that have completed long in-reactor service, to ensure that the mechanisms observed in accelerated aging experiments are the same as those occurring in-reactor. Cast stainless steel materials from the decommissioned Shippingport reactor offer a unique opportunity to validate and benchmark the laboratory studies.

18524 (NUREG/CP–0118, pp. 6.11-6.12) **Progress in research on aging of structures.** Naus, D.J. (Oak Ridge National Lab., TN (United States)); Oland, C.B.; Ellingwood, B.; Mori, Y.; Arndt, E.G. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC05-84OR21400. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Structural Aging Program has the overall objective of preparing a report which provides US Nuclear Regulatory Commission (USNRC) license reviewers and licensees with: (1) identification and evaluation of the degradation processes that affect the performance of structural components; (2) issues to be addressed under nuclear power plant continued service reviews, as well as criteria, and their bases, for resolution of these issues; (3) identification and evaluation of relevant inservice inspection (or structural assessment) and repair programs in use, or needed; and (4) quantitative methodologies for assessing current, or predicting future, structural safety margins. The results of this program will provide an improved basis for the USNRC staff to permit continued operation near, at, or beyond the nominal 40-year design life of a nuclear power plant.

18525 (NUREG/CP–0118, pp. 6.7-6.8) **Experiments on containment performance under severe accident loadings.** Parks, M.B. (Sandia National Labs., Albuquerque, NM (United States)); Spletzer, B.L.; Lambert, L.D. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The primary purpose of this paper is to provide a status report on two ongoing research programs to examine the behavior of components of the containment pressure boundary under severe accident conditions. The first program to be presented is a series of 'separate effects' tests to investigate possible tearing of the steel liner in concrete (reinforced and prestressed) containments due to overpressurization of the containment building. An experimental study to determine the conditions that would cause leakage past penetration bellows is also described. The research work described herein is a part of the Containment Integrity Programs. These Programs are being conducted at Sandia National Laboratories under the sponsorship of the US Nuclear Regulatory Commission (NRC).

18526 (NUREG/CP–0118, pp. 6.9-6.10) **High level seismic/vibrational tests at the HDR - An overview.** Kot, C.A. (Argonne National Lab., IL (United States)); Srinivasan, M.G.; Hsieh, B.J.; Schrammel, D.; Malcher, L.; Steinhilber, H.; Costello, J.F. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

In the Phase 2 testing conducted by the Kernforschungszentrum Karlsruhe (KfK), FGR, at the HDR (Heissdampfreaktor) Test Facility in Kahl/Main, FRG, high-level seismic/vibrational experiments were performed on the reactor building, structures, components and piping. In the first series of tests called SHAG, performed in 1986, the entire reactor building was subjected to high-level vibrational excitation by means of a large eccentric mass shaker, capable of generating loads in excess of 10^4 kN (1,000 tons) and located on the reactor operating floor. The purpose of these experiments was to study soil-structure interaction (SSI), load transmission, and response of the as-built structure, components, vessels and piping under strong vibrational excitation equivalent to the levels experienced in design basis earthquakes (SSE and OBE). Specifically the nonlinear behavior of the structural systems was of interest. Other objectives were to validate/verify nonlinear calculational procedures and to evaluate the performance of various dynamic pipe support configurations. A second series of tests called SHAM was conducted at the HDR in 1988. The objectives of these experiments were to (1) study the response of piping subjected to seismic excitations that exceed design levels manifold and which may result in failure/plastification of pipe supports and pipe elements; (2) provide data for the validation of linear and nonlinear pipe response analysis; (3) compare and evaluate, under identical loading conditions, the performance of various dynamic pipe support systems, ranging from very flexible to very stiff configurations; and (4) establish seismic margins for piping and dynamic pipe supports.

18527 (NUREG/CP–0118, pp. 7.1-7.2) **Aging study of the 1E Power and Reactor Protector Systems: An evaluation of monitoring and surveillance effectiveness.** Sharma, V. (Idaho National Engineering Lab., Idaho Falls (United States)); Edson, J.L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Idaho National Engineering Laboratory (INEL) performed an aging study of the Class 1E Power (1E) and Reactor Protection Systems (RPS) in support of the US Nuclear Regulatory Commission's (USNRC) Nuclear Plant Aging Research (NPAR) Program. This research program consisted of: (1) an examination of operational data to identify those failing components that were not being detected by routine inspection, surveillance and monitoring methods (IS and MM); (2) an investigation of improved IS and MM practices applicable to the Class 1E and Reactor Protection Systems; and (3) an identification of the risk significant components in the Class 1E Power system and the effects of aging upon their failure probabilities. The program results are summarized.

18528 (NUREG/CP–0118, pp. 7.13-7.14) **Extensions and applications of degradation modeling.** Hsu, F. (Brookhaven National Lab., Upton, NY (United States)); Subudhi, M.; Samanta, P.K.; Vesely, W.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Component degradation modeling being developed to understand the aging process can have many applications with potential advantages. Previous work has focused on developing the basic concepts and mathematical development of a simple degradation model. Using this simple model, times of degradations and failures occurrences were analyzed for standby components to detect indications of aging and to infer the effectiveness of maintenance in preventing age-related degradations from transforming to failures. Degradation modeling approaches can have broader applications in aging studies and in this paper, the authors discuss some of the extensions and applications of degradation modeling. The extensions and applications of the degradation modeling approaches discussed are: (a) theoretical developments to study reliability effects of different maintenance strategies and policies, (b) relating aging-failure rate to degradation rate, and (c) application to a continuously operating component.

18529 (NUREG/CP–0118, pp. 7.15-7.16) **Risk evaluations of aging: Procedures guide for an age-dependent PSA with emphasis on prioritization and sensitivity studies.** Vesely, W.E. (Science Applications International Corp., Columbus, OH (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Based on the previous work which has been performed in the project, a procedures guide is being developed for carrying out an age-dependent probabilistic safety assessment (PSA) for evaluating the core damage frequency with aging effects explicitly treated. A PSA is basically a Level 1 Probabilistic Risk Assessment (PRA). The emphasis of the guide is on prioritization and sensitivity studies. Focus is also on active components although consideration of aging effects in passive components is also treated. The guide is intended to become a NUREG/CR and is the first of three volumes which are being developed. The following topics with demonstrations and applications are described in the presentation: (1) the age-dependent PSA versus the standard PSA; (2) component reliability models used in an age-dependent PSA; (3) approaches for transforming a PSA into an age-dependent PSA; (4) application of an age-dependent PSA; (5) using a PSA to evaluate the risk effects from aging passive components; (6) evaluation of the risk importance of passive components; (7) prioritizations of aging contributors; (8) evaluations of test and maintenance effectiveness; and (9) sensitivity studies and uncertainty analyses of aging effects.

18530 (NUREG/CP–0118, pp. 7.3-7.4) **An aging assessment of transformers in 1E power systems.** Edson, J.L. (Idaho National Engineering Lab., Idaho Falls (United States)); Roberts, E.W. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper presents the findings of the Idaho National Engineering Laboratory (INEL) Phase 1 study of the effects of age on nuclear power plant Class 1E power transformers, the significance of transformer aging on plant safety, and the capabilities to mitigate the effects of transformer aging to prevent risk significant failures. The following areas were included in the INEL study: The characteristics of Class 1E power transformers used in nuclear power plants were determined. All known transformer stressors were identified, their effect on transformer materials determined, and the effects of these stressors with time assessed. On- and off-line techniques to detect the degradation of all types of transformers were identified and their effectiveness examined. The information provided in reactor operation data bases was evaluated. The capability of various recommendations to mitigate the effects of transformer aging and prevent unexpected transformer failures was evaluated. The risk significance of transformer aging was determined. Conclusions have been made on the effects of aging on transformer performance, the capability to prevent/detect/mitigate aging effects prior to transformer failure, and the effectiveness of current maintenance and monitoring methods.

18531 (NUREG/CP–0118, pp. 7.5-7.6) **New method for detecting degradation in installed cables in nuclear power plants.** Kusama, Yasuo (Japan Atomic Energy Research Inst., Tokyo (Japan)); Yagi, Toshiaki; Morita, Yousuke; Kamimura, Seiji; Yagyu, Hideki. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Simple and precise methods for detecting degradation in installed cables in nuclear power plants are expected to develop from the viewpoint of the safety operation and the life extension of the plants. Generally, the degradation of cable insulation by thermal and/or radiation aging has been examined by tensile tests, and the degree of degradation was evaluated from the ultimate strength and elongation. The degradation of cables installed in the facility is likely to be detected by non-destructive techniques. For this purpose, two kinds of detecting methods i.e., (a) torque-strain response and (b) thermal gravimetry were studied in order to apply to the low voltage cables, for which effective detecting methods have not been completed. The paper describes a basic idea to determine degradation of the low voltage CV-cables (polyethylene insulation, polyvinylchloride jacket). Elongation at break was used as a primary standard to evaluate availability of the methods.

18532 (NUREG/CP–0118, pp. 7.7-7.8) **Detecting and mitigating aging in component cooling water systems.** Lofaro, R.J. (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The component cooling water (CCW) system is one of many systems that is important for safe operation of nuclear power plants. In a research program sponsored by the US Nuclear Regulatory Commission (NRC), the CCW system has been studied to determine how aging affects its performance and reliability. The study was performed in two phases and included extensive analyses of data obtained from national data bases, as well as data obtained from actual plant visits. This paper discusses how the results of those analyses can be used to help detect and mitigate the effects of aging in CCW systems.

18533 (NUREG/CP–0118, pp. 7.9-7.10) **The effects of aging on friction of MOVs.** Hunt, T.H. (Idaho National Engineering Lab., Idaho Falls (United States)); Sinha, U.P. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This report studied the effect of three aging mechanisms: corrosion, erosion, and deposition on the friction coefficients of the sliding surfaces of motor-operated valves (MOVs) used in nuclear plant systems. The US Nuclear Regulatory Commission (NRC) sponsored the study, and it was performed following the guidelines of their Nuclear Plant Aging Research (NPAR) program. The authors reached three general conclusions: corrosion and deposition should not prevent valve operation by obstructing the mechanical tolerances of the MOVs; the aging mechanisms may increase the friction coefficients due to roughening the surfaces with age; and the codes and standards defining MOV surveillance requirements need review to include methods for detecting aging degradation.

18534 (NUREG/CP--0118, pp. 8.5-8.6) **An approach for assessing ALWR passive safety system reliability.** Hake, T.M. (Sandia National Labs., Albuquerque, NM (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC04-76DP00789. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Many of the advanced light water reactor (ALWR) concepts proposed for the next generation of nuclear power plants rely on passive rather than active systems to perform safety functions. Despite the reduced redundancy of the passive systems as compared to active systems in current plants, the assertion is that the overall safety of the plant is enhanced due to the much higher expected reliability of the passive systems. In order to investigate this assertion, a study is being conducted at Sandia National Laboratories to evaluate the reliability of ALWR passive safety features in the context of probabilistic risk assessment (PRA). The purpose of this paper is to provide a brief overview of the approach to this study. The quantification of passive system reliability is not as straightforward as for active systems, due to the lack of operating experience, and to the greater uncertainty in the governing physical phenomena. Thus, the adequacy of current methods for evaluating system reliability must be assessed, and alternatives proposed if necessary. For this study, the Westinghouse Advanced Passive 600 MWe reactor (AP600) was chosen as the advanced reactor for analysis, because of the availability of AP600 design information. This study compares the reliability of AP600 emergency cooling system with that of corresponding systems in a current generation reactor.

18535 (NUREG/CP--0118, pp. 8.7-8.8) **AP600 test/analysis program to support design certification.** Hochreiter, L.E.; Conway, L.E.; Piplica, E.J.; Conway, L.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Westinghouse, the Dept. of Energy, and the Electrical Power Research Institute, have joined together to complete the design of an advanced pressurized water reactor (PWR) which incorporates passive safety features - the AP600. The design goals for the AP600 are stated. One key feature of the AP600 design is the use of safety grade passive safety systems which provide the ultimate core and containment cooling for postulated accidents. The strategy in the AP600 test program is to concentrate on large-to-full scale component tests to develop the thermal-hydraulic models needed for the safety analysis codes. The analysis program for the AP600 will use best estimated state-of-the-art computer codes to analyze and quantify the safety system performance and design margin. The WCOBRA/TRAC code will be used for the small and large break LOCA's. The containment analysis will be performed using the GOTHIC code which is an improved version of the COBRA/NC containment code and is capable of modeling the natural circulation and convective flow patterns, and condensation inside the containment as well as the evaporative film cooling on the outside of the containment shell. Using the best analysis tools available, and by performing the above AP600 safety systems experiments, the AP600 passive safety systems can be accurately characterized such that the design will be acceptable to the Nuclear Regulatory Commission and the public.

18536 (NUREG/CP--0118, pp. 8.9-8.10) **Preliminary analyses of AP600 using RELAP5.** Modro, S.M. (Idaho National Engineering Lab., Idaho Falls (United States)); Beelman, R.J.; Fisher, J.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. DOE Contract AC07-76ID01570. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

This paper presents results of preliminary analyses of the proposed Westinghouse Electric Corporation AP600 design. AP600 is a two loop, 600 MW (e) pressurized water reactor (PWR) arranged in a two hot leg, four cold leg nuclear steam supply system (NSSS) configuration. In contrast to the present generation of PWRs it is equipped with passive emergency core coolant (ECC) systems. Also, the containment and the safety systems of the AP600 interact with the reactor coolant system and each other in a more integral fashion than present day PWRs. The containment in this design is the ultimate heat sink for removal of decay heat to the environment. Idaho National Engineering Laboratory (INEL) has studied applicability of the RELAP5 code to AP600 safety analysis and has developed a model of the AP600 for the Nuclear Regulatory Commission. The model incorporates integral modeling of the containment, NSSS and passive safety systems. Best available preliminary design data were used. Nodalization sensitivity studies were conducted to gain experience in modeling of systems and conditions which are beyond the applicability of previously established RELAP5 modeling guidelines or experience. Exploratory analyses were then undertaken to investigate AP600 system response during postulated accident conditions. Four small break LOCA calculations and two large break LOCA calculations were conducted.

18537 (NUREG/CP--0118, pp. 9.1-9.2) **Expanding the modeling capabilities of the cognitive environment simulation.** Roth, E.M. (Westinghouse Science and Technology Center, Pittsburgh, PA (United States)); Mumaw, R.J.; Pople, H.E. Jr. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Nuclear Regulatory Commission has been conducting a research program to develop more effective tools to model the cognitive activities that underlie intention formation during nuclear power plant (NPP) emergencies. Under this program an artificial intelligence (AI) computer simulation called Cognitive Environment Simulation (CES) has been developed. CES simulates the cognitive activities involved in responding to a NPP accident situation. It is intended to provide an analytic tool for predicting likely human responses, and the kinds of errors that can plausibly arise under different accident conditions to support human reliability analysis. Recently CES was extended to handle a class of interfacing loss of coolant accidents (ISLOCAs). This paper summarizes the results of these exercises and describes follow-on work currently underway.

18538 (NUREG/CP--0118, pp. 9.11-9.12) **Organizational processes and nuclear power plant safety.** Landy, F.J. (Pennsylvania State Univ., University Park (United States)); Jacobs, R.R.; Mathieu, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079--: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The paper describes the effects organizational factors have on the risk associated with the operation of nuclear power plants. The described research project addresses three methods for identifying the organizational factors that impact safety. The first method consists of an elaborate theory-based protocol dealing with decision making procedures, interdepartmental coordination of activities, and communications. The second, known as goals/means/measures protocol, deals with identifying safey related goals. The third method is known as behaviorally anchored rating scale development. The paper discusses the importance of the convergence of these three methods to identify organizational factors essential to reactor safety.

18539 (NUREG/CP–0118, pp. 9.13-9.14) **Including test errors in evaluating surveillance test intervals.** Kim, I.S. (Brookhaven National Lab., Upton, NY (United States)); Samanta, P.K.; Martorell, S.; Vesely, W.E. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

To evaluate the risk impact of surveillance requirements defined in Technical Specifications, both the beneficial and negative effects of surveillance should be considered. The negative effect of surveillance testing can be caused by test errors, e.g., human errors of omission or commission including potential for common cause failures. As a consequence of the negative effect, the performance of periodic testing can have adverse impact on safety. This paper defines the various negative effects of surveillance testing from a risk perspective, and then presents a methodology to quantify the negative risk impact, i.e., the risk penalty or risk increase caused by the test. The paper presents a PRA-based method to evaluate the negative risk impact due to test-caused plant transients and a method based on a test-caused equipment degradation model and PRA to assess the negative risk impact associated with equipment wear-out. Also described in the paper are illustrative applications of the methods to specific surveillance tests conducted at boiling water reactors (BWRs) such as the tests of main steam isolation valves (MSIVs), turbine overspeed protection system, and diesel generators. Evaluation results of the risk effectiveness of the tests are presented along with the insights from the sensitivity analysis of the risk impact versus test interval.

18540 (NUREG/CP–0118, pp. 9.3-9.6) **Human Performance Investigation Process (HPIP).** Paradies, M.; Unger, L. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

The Human Performance Investigation Process (HPIP) is a systematic method for use by Nuclear Regulatory Commission (NRC) personnel investigating incidents that include human error. The combination of techniques into an investigation procedure is designed to help investigators (for example, a typical resident inspector with little human factors training) find the root causes of human performance problems that contributed to the incident. This summary briefly outlines the process and the techniques. The full paper provides a more in-depth description of the process, the techniques, and their development and evaluation. The complete documentation of the process will be presented in NUREG/CR-5455, Development of the NRC Human Performance Investigation Process (HPIP) to be published late in 1991.

18541 (NUREG/CP–0118, pp. 9.7-9.9) **Organizational factors influencing improvements in safety.** Marcus, A. (Univ. of Minnesota, Minneapolis (United States)); Nichols, M.L.; Olson, J.; Osborn, R.; Thurber, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Oct 1991. (CONF-911079–: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). In *Transactions of the nineteenth water reactor safety information meeting.* 220p. Source: OSTI; NTIS; INIS; GPO.

Results of conceptual and empirical research conducted by this research team, and published in NUREG-CR 5437, suggested that processes of organizational problem solving and learning provide a promising area for understanding improvement in safety-related performance in nuclear power plants. In this paper the authors describe the way in which they have built upon that work and gone much further in empirically examining a range of potentially important organizational factors related to safety. The paper describes (1) overall trends in plant performance over time on the Nuclear Regulatory Commission performance indicators, (2) the major elements in the conceptual framework guiding the current work, which seeks among other things to explain those trends, (3) the specific variables used as measures of the central concepts, (4) the results to date of the quantitative empirical work and qualitative work in progress, and (5) conclusions from the research.

18542 (NUREG/CR–4831) **State of the art in evacuation time estimate studies for nuclear power plants.** Urbanik, T.E. (Pacific Northwest Lab., Richland, WA (United States)); Jamison, J.D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Radiation Protection and Emergency Preparedness; Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 13p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–7776). Source: OSTI; NTIS; INIS; GPO.

In the event of a major accident at a commercial nuclear power station, exposure of the public to airborne radioactive materials can be prevented or greatly reduced by evacuating the area immediately surrounding the reactor site. Reactor licensees are required to conduct studies to estimate the time needed to evacuate the public from the area surrounding each nuclear power station. The results of such studies are used by regulatory personnel and emergency planners to assess the potential effectiveness of protective responses for the public. The time required to evacuate the public from a 10-mile emergency planning radius is estimated by analyzing the available transportation facilities and other relevant conditions within this radius. To support the analysis, data must be collected and assumptions must be made regarding the transportation facilities, the size and characteristics of the population and other conditions in the planning zone. This report describes standard approaches and provides recommendations regarding the relevant information, assumptions and methods to be used in performing evacuation time estimate studies.

18543 (NUREG/CR–5604-Vol.2) **Assessment of ISLOCA risk: Methodology and application to a Babcock and Wilcox nuclear power plant: Volume 2, Appendices A–H.** Galyean, W.J. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Gertman, D.I. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 467p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2608-Vol.2). Source: OSTI; NTIS; INIS; GPO.

This report presents information essential to understanding the risk associated with inter-system loss-of-coolant accidents (ISLOCAs). The methodology developed and presented in the report provides a state-of-the-art method for identifying and evaluating plant-specific hardware design, human performance issues, and accident consequence factors to relevant to the prediction of the ISLOCA risk. This ISLOCA methodology was developed and then applied to a Babcock and Wilcox (B&W) nuclear power plants. The results from this application are described in detail. For this particular B&W reference plant, the assessment indicated that the probability of a severe ISLOCA is approximately 2.2E-06/reactor-year. This document Volume 3 provides appendices A–H of the report. Topics are: Historical experience related to ISLOCA events; component failure rates; reference B&W plant system descriptions; reference B&W plant ISLOCA event trees; Human reliability analysis for the B&W ISLOCA probabilistic risk assessment; thermal hydraulic calculations; bounding core uncovery time calculations; and system rupture probability.

18544 (NUREG/CR–5633) **Auxiliary feedwater system risk-based inspection guide for the Turkey Point nuclear power plant.** Moffitt, N.E. (Pacific Northwest Lab., Richland, WA (United States)); Gore, B.F.; Vo, T.V. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Radiation Protection and Emergency Preparedness; Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 30p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–7454). Source: OSTI; NTIS; INIS; GPO.

In a study sponsored by the US Nuclear Regulatory Commission (NRC), Pacific Northwest Laboratory has developed and applied a methodology for deriving plant-specific risk-based inspection guidance for the auxiliary feedwater (AFW) system at pressurized water reactors that have not undergone probabilistic risk assessment

(PRA). This methodology uses existing PRA results and plant operating experience information. Existing PRA-based inspection guidance information recently developed for the NRC for various plants was used to identify generic component failure modes. This information was then combined with plant-specific and industry-wide component information and failure data to identify failure modes and failure mechanisms for the AFW system at the selected plants. Turkey Point was selected as one of a series of plants or study. The product of this effort is a prioritized listing of AFW failure which have occurred at the plant and at other PWRs. This listing is intended for use by NRC inspectors in the preparation of inspection plans addressing AFW risk-important components at the Turkey Point plant.

18545 (NUREG/CR–5821) **Auxiliary feedwater system risk-based inspection guide for the Kewaunee nuclear power plant.** Lloyd, R.C. (Pacific Northwest Lab., Richland, WA (United States)); Gore, B.F.; Vo, T.V.; Pugh, R.; Moffitt, N.E. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Radiation Protection and Emergency Preparedness; Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 27p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–7724). Source: OSTI; NTIS; INIS; GPO.

In a study sponsored by the US Nuclear Regulatory Commission (NRC), Pacific Northwest Laboratory has developed and applied a methodology for deriving plant-specific risk-based inspection guidance for the auxiliary feedwater (AFW) system at pressurized water reactors that have not undergone probabilistic risk assessment (PRA). This methodology uses existing PRA results and plant operating experience information. Existing PRA-based inspection guidance information recently developed for the NRC for various plants was used to identify generic component failure modes. This information wash then combined with plant-specific and industry-wide component information and failure data to identify failure modes and failure mechanisms for the AFW system at the selected plants. Kewaunee was selected as one of a series of plans for study. The product of this effort is a prioritized listing of AFW failures which have occurred at the plant and at other PWRs. This listing is intended for use by NRC inspectors in the preparation of inspection plans addressing AFW risk-important components at the Kewaunee plant.

18546 (NUREG/CR–5841) **Verification of nonlinear piping response calculation with data from seismic testing of an in-plant piping system.** Srinivasan, M.G. (Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering); Mojtahed, M.; Kot, C.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Argonne National Lab., IL (United States). Mar 1992. 206p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (ANL–92/4). Source: OSTI; NTIS; INIS; GPO.

The nonlinear piping analysis code NONPIPE was evaluated by modeling and performing posttest calculations for a high level seismic test performed on an in-plant piping system at the HDR test facility in Germany. The piping used only rigid struts for dynamic supports and experienced significant nonlinear response and plastic deformation in the test. The calculated responses in general had the same time trends as the measurements but were quite variable in estimating peak values. Peak strains were overestimated, and shear strains to a greater degree than bending strains. Peak strut forces were underestimated as a group. On the average the displacements were estimated close to the measurements and the accelerations were overestimated. Spatial consistency in displacement and strut force estimates was better than for accelerations. Qualitatively the analytical predictions are similar to experimental observations and they provide quantitative estimates that are useful for practical purposes. The modeling aspects that contribute to large discrepancies are identified. Both the experiments and calculations clearly indicate that piping is all but immune to gross failure even when subjected to extreme seismic loading.

18547 (NUREG/CR–5855) **Thermal-hydraulic processes during reduced inventory operation with loss of residual heat removal.** Naff, S.A. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Johnsen, G.W.; Palmrose, D.E.; Hughes, E.D.; Kullberg, C.M.; Arcieri, W.C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 224p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2671). Source: OSTI; NTIS; INIS; GPO.

Nuclear power plant conditions during outages differ markedly from those prevailing at normal full-power operation on which most past research has concentrated. This report identifies the topics needed to understand pressurized water reactor response to an extended loss-of-residual heat removal event during refueling and maintenance outages. By identifying the possible plant conditions and cooling methods that might be used, the controlling thermal-hydraulic processes and phenomena were identified. Gravity drain into the reactor coolant system, core water boil-off, and reflux condensation cooling were investigated in detail for example plants from each of the three US pressurized water reactor vendors. The reactor coolant system pressure that would result from reflux cooling was calculated under various assumed conditions and compared to threshold pressures for various temporary closures that might be in use. The viability of various potential gravity feed-and-bleed approaches also was studied.

18548 (NUREG/IA–0027) **TRAC-PF1/MOD1 calculations of LOFT experiment LP-02-6.** Coddington, P. (UKAEA Atomic Energy Establishment, Winfrith (United Kingdom)); Gill, C. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; UKAEA Atomic Energy Establishment, Winfrith (United Kingdom). Apr 1992. 262p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (AEEW-M–2464). Source: OSTI; NTIS; INIS; GPO.

This report provides a description of the results of four TRAC-PF1/MOD1 calculations of the OECD-LOFT experiment LP-02-6. This experiment was the third of the high power LOFT large break experiments (L2-3 and L2-5 being the previous two experiments) and although it was performed at the beginning of the OECD-LOFT project, the boundary conditions for the experiment were specified by the USNRC. The primary boundary conditions that distinguish this experiment from the previous experiments L2-3 and L2-5 were the increased power, ie 47 MW and the fact that the primary coolant pumps were tripped but not decoupled from their flywheel systems at the start of the transient. This resulted in a positive (bottom-up) core flow during the blowdown period, ie at about 5 secs, but the magnitude of this flow was less than that observed in the earlier experiment L2-3 where the pumps where kept running, such that the fuel rod external thermocouples quenched immediately only in the bottom 2/3 rds of the central fuel assembly. The remainder of the core (ie the top 1/3 rd) quenched subsequently during the top-down flow period after about 12 secs.

18549 (NUREG/IA–0036) **Analysis of LOBI test BLO2 (three percent cold leg break) with RELAP5 code.** Scriven, A.H. (Central Electricity Research Labs., Leatherhead (United Kingdom)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Central Electricity Research Labs., Leatherhead (United Kingdom). Mar 1992. 68p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (TPRD/L–3209/R87;PWR-HTWG-P–87-496). Source: OSTI; NTIS; INIS; GPO.

The test BL02 was a United Kingdom specified test conducted on the electrically heated 2-loop test system at Ispra, North Italy, as part of the LOBI 'B' series of tests sponsored by the Joint European Research Commission. The pretest calculations for this test were performed with the RELAP5/MOD1 code and the post-test analysis was carried out using RELAP5/MOD2. Comparisons between the code predictions and the text data are given, and for the case of the post-test MOD2 calculation, detailed studies of the codes performance in a number of areas are included.

18550 (NUREG/IA–0037) **Assessment of RELAP5/MOD2, Cycle 36.04 against LOFT small break experiment L3-5.** Eriksson, J. (Swedish Nuclear Power Inspectorate, Nykoeping (Sweden)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Swedish Nuclear Power Inspectorate, Nykoeping (Sweden). Mar 1992. 89p.

Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (STUDSVIK/NP–87/63). Source: OSTI; NTIS; INIS; GPO.

The LOFT small break experiment L3-5 has been analyzed using the RELAP5/MOD2 code. The code version used, Cycle 36.04, is a frozen version of the code. Three calculations were carried out in order to study the sensitivity to changes of steam generator modeling and of core bypass flow. The differences between the calculations and the experiment have been quantified over intervals in real time for a number of variables available from the experiment.

18551 (NUREG/IA–0038) **Assessment of TRAC-PF1/MOD1 against an inadvertent feedwater line isolation transient in the Ringhals 4 power plant.** Sjoberg, A. (Swedish Nuclear Power Inspectorate, Nykoeping (Sweden)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Swedish Nuclear Power Inspectorate, Nykoeping (Sweden). Mar 1992. 59p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (STUDSVIK/NP–88/101). Source: OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020.

An inadvertent feedwater line isolation transient in a three loop Westinghouse PWR has been simulated with the frozen version of the TRAC-PF1/MOD1 computer code. The results reveal the capacity of the code to quantitatively predict the different pertinent phenomena. For accurate predictions of the system response it was found that a careful nodalization of the steam generator downcomer was essential for accurate pressure distribution and associated level prediction. Also the core moderator temperature reactivity coefficient was recommended to be decreased somewhat (be less negative) whereas the fuel gap conductance should be rather low in order to increase the initial stored energy of the fuel rods. It was also found during the course of the calculations that some restrictions had to be imposed on the allowable maximum timestep size in order not to violate the convergence of the solution procedure.

18552 (NUREG/IA–0041) **Assessment of TRAC-PF1/MOD1 against an inadvertent steam line isolation valve closure in the Ringhals 2 power plant.** Pelayo, F. (Consejo de Seguridad Nuclear, Madrid (Spain)); Sjoberg, A. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Consejo de Seguridad Nuclear, Madrid (Spain); Studsvik Energiteknik AB, Nykoeping (Sweden). Mar 1992. 48p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

A TRAC-PF1/MOD1 simulation has been conducted to assess the capability of the code to predict a steam line isolation valve closure transient. Extensive use of results from Ringhals 2 data acquisition system was made to drive the initial conditions and some of the necessary boundary conditions. The results of the simulation revealed the importance of proper modeling of steam generator internals as well as the modeling of pressurizer walls and spray nozzles in order to reasonably predict the condensation phenomena.

18553 (NUREG/IA–0043) **Assessment study of RELAP5/MOD2 Cycle 36.04 based on the DOEL-4 manual loss of load test of November 23, 1985.** Stubbe, E.J. (TRACTEBEL, Brussels (Belgium)); Deschutter, P. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; TRACTEBEL, Brussels (Belgium). Mar 1992. 40p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The loss of external load test conducted on the DOEL-4 power plant has been analyzed on the basis of a high quality data acquisition system. A detailed numerical analysis of the transient by means of the best estimate code RELAP5/MOD2 is presented. The RELAP5 code is capable to simulate the basic plant behavior. Deficiencies noted involved structural heat simulation, acoustic phenomena, and excessive interphase drag.

18554 (NUREG/IA–0057) **Assessment study of RELAP5/MOD2 Cycle 36.04 based on the commissioning test reactor trip at full load at the Philippsburg 2 nuclear power plant.** Gerth, G. (Siemens AG Unternehmensbereich KWU, Erlangen (Germany). Bereich Energieerzeugung). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Siemens AG Unternehmensbereich KWU, Erlangen (Germany). Bereich Energieerzeugung. Apr 1992. 74p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The commissioning test "Reactor Trip at Full Load," which was performed at the nuclear power plant Philippsburg 2 (KKP 2), was recalculated with RELAP5/MOD2. The comparison of the results with the commissioning test results shows very good agreement between measurement and calculation. Difficulties arised attempting to adjust the RPV inlet temperature, which depends on the steam generator pressure, to the initial test condition. It is assumed that the heat transfer correlations in RELAP5/MOD2 are not optimized for this problem. The deviation of SG water level during the transient between calculation and measurement is assumed to be caused by the separator model in RELAP5/MOD2.

18555 (NUREG/IA–0058) **RELAP5/MOD2 analysis of LOFT Experiment L9-3.** Birchley, J.C. (UKAEA Atomic Energy Establishment, Winfrith (United Kingdom)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; UKAEA Atomic Energy Establishment, Winfrith (United Kingdom). Apr 1992. 52p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (AEEW-R–2435;PWR/PKWG/P–88-390). Source: OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020.

An analysis has been performed of LOFT Experiment L9-3, a loss-of-feedwater anticipated transient without trip, in order to support the validation of RELAP5/MOD2. Experiment L9-3 exhibited a rapid boildown of the steam generator, following the loss of feed, with the reactor remaining close to its initial power until the steam generator tubes became sufficiently uncovered for primary to secondary heat transfer to be significantly reduced. The ensuing heat up of the primary fluid resulted in a reduction in power induced by the moderator feedback. The primary system pressure increased to the safety relief valve setpoint, before the fall in reactor power allowed the mismatch between primary system heat input and heat removal via the steam generator to be accommodated by cycling of the pilot operated relief valve (PORV). Comparison between calculation and data shows generally good agreement, though with discrepancies in some areas. Weaknesses in the code's treatment of interphase drag and in the representation of the pressuriser spray are indicated, although a shortage of definitive data, particularly in the steam generator, may also be a factor. The overprediction of interphase drag led to a tendency to underpredict the initial inventory in the steam generator and also, perhaps, to overpredict the steam generator heat transfer while the tubes were being uncovered. There is indication that the pressuriser vapour region conditions were close to equilibrium during spray operation. The point kinetics model in RELAP5/MOD2 proved a viable means of representing the power history for this transient.

18556 (NUREG/IA–0059) **Assessment of RELAP5/MOD2 against natural circulation experiments performed with the REWET-III facility.** Hyvaerinen, J. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland). Nuclear Engineering Lab.); Kervinen, T. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland). Nuclear Engineering Lab. Apr 1992. 64p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Natural circulation experiments carried out in the REWET-III facility in 1985 have been used for RELAP5/MOD2 assessment. The REWET-III facility is a scaled-down model of VVER-440 type reactors. The facility consists of a pressure vessel in which the downcomer is simulated with an external pipe assembly, hot and cold legs with loop seals and a horizontal steam generator. The volume scaling factor compared to the reference reactor is 1:2333. The present paper summarizes the experiences gained in the RELAP5/MOD2 calculations of selected REWET-III single- and two-phase natural circulation experiments. The code's ability to represent the main phenomena of experiments in both cases was satisfactory.

18557 (NUREG/IA–0069) **Assessment of RELAP5/MOD2, Cycle 36.04 using LOFT intermediate break experiment L5-1.** Lee, E.J. (Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of)); Chung, B.D.; Kim, H.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of). Apr 1992. 141p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020.

This document the LOFT intermediate break experiment L5-1, which simulates 12 inch diameter ECC line break in a typical PWR, and has been analyzed using the reactor thermal/hydraulic analysis code RELAP5/MOD2, Cycle 36.04. The base calculation, which modeled the core with single flow channel and two heat structures without using the options of reflood and gap conductance model, has been successfully completed and compared with experimental data. Sensitivity studies were carried out to investigate the effects of nodalization at reactor vessel and core modeling on major thermal hydraulic parameters, especially on peak cladding temperature (PCT). These sensitivity items are: single flow channel and single heat structure (Case A), two flow channel and two heat structures (Case B), reflood option added (Case C) and both reflood and gap conductance options added (Case D). The code, RELAP5/MOD2 Cycle 36.04 with the base modeling, predicted the key parameters of LOFT IBLOCA Test L5-1 better than Cases A, B, C, and D. Thus, it is concluded that the single flow channel modeling for core is better than the two flow channel modeling and two heat structure is also better than single heat structure modeling to predict PCT at the central fuel rods. It is recommended to use the reflood option and not to use gap conductance option for this L5-1 type IBLOCA.

18558 (NUREG/IA–0070) **Assessment of RELAP5/MOD2 Cycle 36.04 with LOFT large break LOCE L2-3.** Bang, Y.S. (Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of)); Kim, H.J.; Kim, S.H. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of). Apr 1992. 143p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; GPO; INIS; NTIS.

The LOFT LOCE L2-3 was simulated using the RELAP5/MOD2 Cycle 36.04 code to assess its capability to predict the thermal-hydraulic phenomena in LBLOCA of the PWR. The reactor vessel was simulated with two core channels and split downcomer modelling for a base case calculation using the frozen code. From the results of the base case calculation, deficiencies of the critical flow model and the CHF correlation at high flow rate were identified, and the severeness of the rewetting criteria were also found. Additional calculation using an updated version of RELAP5/MOD2 Cycle 36.04 including modifications of the rewet criteria shows a substantial improvement in the core thermal response.

18559 (PNL–8080) **US Department of Energy Chernobyl accident bibliography.** Kennedy, R.A.; Mahaffey, J.A.; Carr, F. Jr. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013702. Source: OSTI; NTIS; INIS; GPO Dep.

This bibliography has been prepared by Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE) Office of Health and Environmental Research to provide bibliographic information in a usable format for research studies relating to the Chernobyl nuclear accident that occurred in the Ukrainian Republic, USSR in 1986. This report is a product of the Chernobyl Database Management project. The purpose of this project is to produce and maintain an information system that is the official United States repository for information related to the accident. Two related products prepared for this project are the Chernobyl Bibliographic Search System (ChernoLit™) and the Chernobyl Radiological Measurements Information System (ChernoDat). This report supersedes the original release of Chernobyl Bibliography (Carr and Mahaffey, 1989). The original report included about 2200 references. Over 4500 references and an index of authors and editors are included in this report.

18560 (RER-K–2239-Del.) **Fan EG Set No. 2 insulation degraded: Reactor event report.** Burke, S.D. Westinghouse Savannah River Co., Aiken, SC (United States). 25 Aug 1989. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92011596. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The insulation surrounding a connection between the EG Set No. 2 and a power lead to the fans was degraded. During completion of DPSOL's 105-1880, Exhaust Fan Backup Power Check, and 105-1881, Operation of the Fans, an electrical arc between the wires and the junction box cover burned a hole in the insulation and the junction box cover. The event occurred after deenergizing the building power source for fan. The EG Set No. 2 started as designed, to provide emergency backup power for fan. An operator observed sparks being emitted from the junction box cover of the EG Set as it started. Supervision was notified and the EG Set No. 2 was shut down and placed in a safe configuration. Fan was promptly restarted and continued to operate on the containment electrical source. Investigation revealed a 3/8 inch hole burned in the cover of the junction box which houses the power connections. A hole was also burned in the electrical tape which serves as insulation for the connection between the EG Set No. 2 generator and the power leads the Double Throw Switch for the fans.

18561 (RER-L–795-Del.) **Degraded cooling water gravity flow capabilities.** Rennie, D.P. Westinghouse Savannah River Co., Aiken, SC (United States). 12 Jun 1989. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92011595. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. VALVES/failures; SPECIAL PRODUCTION REACTORS/reactor cooling systems; VALVES; FAILURES; REACTOR SAFETY

18562 (RER-P–1865) **Loss of miscellaneous alarms from −40 foot level.** Burke, S.D. Westinghouse Savannah River Co., Aiken, SC (United States). 8 Feb 1990. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92011619. Source: OSTI; NTIS (US Sales Only); GPO Dep.

At the P Reactor, unknown personnel used tape and a pen shirt-pocket clip to fix the −40 Pump Observation Room miscellaneous annunicator panel (404.B) acknowledge button in the depressed position. This action resulted in the loss of all associated alarms/annunciators in the CCR and the −40 Pump Observation Room. The tape and pen clip were removed to return the panel to an operable state. No abnormal conditions were indicated on the alarm panel. A critique was conducted to determine the cause and corrective actions for the unusual occurrence. Upon further investigation, a person assigned to ESH&QA HP admitted to affixing the pen clip to the acknowledge button. The event occurred as a result of this action. The person responsible for the event was supporting the work being performed on the −40′ level. Per his account, ongoing −40′ level alarms were hampering communications within the work group. These circumstances served as his motivation to tamper with the alarm system. This event demonstrated the capacity of an individual to impede the performance of process safety equipment. As a result, personnel awareness has been increased. Also, the repercussions of such violations has been stressed.

18563 (SAND–91-1173) **Experiments to investigate the effect of water in the cavity on direct containment heating (DCH) in the Surtsey Test Facility: The WC-1 and WC-2 tests.** Allen, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Pilch, M.; Griffith, R.O.; Nichols, R.T. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 67p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013679. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the wet cavity (WC) test series was to investigate the effect of water in a reactor cavity on direct containment heating (DCH). The WC-1 experiment was performed with a dry cavity to obtain baseline data for comparison to the WC-2 experiment. WC-2 was conducted with water 3 cm deep (11.76 kg) in a 1:10 linear scale model of the Zion reactor cavity. The initial conditions for the experiments were similar. For both experiments the molten core debris was simulated by a thermitically generated melt formed from 50 kg of iron oxide/aluminum/chromium powders. After the charge was ignited, the debris was melted by the chemical reaction and was forcibly ejected through a nominal 3.5 cm hole into the scaled reactor cavity by superheated steam at an initial driving pressure of 4.58 MPa. The peak pressure increase in the containment due to the high-pressure melt ejection (HPME) was 0.272 MPa in WC-1 and 0.286 MPa in WC-2. The total amount of hydrogen generated in the experiments was 145 moles of H_2 in WC-1 and 179 moles of H_2 in WC-2. The total mass of debris ejected into the containment was identical for both experiments. These results suggest that water in the cavity slightly enhanced DCH.

18564 (SAND–91-7093) **A review of efforts to determine the effect of age-related degradation on risk.** Donnell, A.P. Jr. (ERC Environmental and Energy Services Co., Albuquerque, NM (United States)). Sandia National Labs., Albuquerque, NM (United States); ERC Environmental and Energy Services Co., Albuquerque, NM (United States). Feb 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013699. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Department of Energy's Plant Lifetime Improvement Program, several Nuclear Regulatory Commission (NRC) reports were reviewed for their relevance to license renewal. The NRC reports outline the research completed under the NRC's Nuclear Plant Aging Research Program (NPAR) to determine the potential increase in risk due to the age-related degradation of reactor components. The work done for the NRC and documented in NUREG/CR-5248, NUREG/CR-5510, and NUREG-1362 draws conclusions about the increase in risk due to continued operation using existing maintenance practices. Although the authors of NUREG/CR-5510 correctly observe that relatively few components contribute to an increase in core damage frequency, at the same time they predict, for example, (1) failure probabilities of 1.0 for motor-operated valves in the last interval prior to replacement, and (2) an average failure probability over the life of the valve that is more than two orders of magnitude higher than the values considered reasonable today and used in the NUREG-1150 PRAs. These predictions are directly responsible for the high risk contributions due to aging reported in NUREG-1362.

18565 (UCRL-JC–108959) **Gaseous core nuclear-driven engines featuring a self-shutoff mechanism to provide nuclear safety.** Heidrich, J.; Pettibone, J.; Chow, Tze-Show; Condit, R.; Zimmerman, G. Lawrence Livermore National Lab., CA (United States). Nov 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9111181–3: 8. biennial nuclear explosives design conference, Albuquerque, NM (United States), 18-22 Nov 1991). Order Number DE92011300. Source: OSTI; NTIS; INIS; GPO Dep.

Nuclear driven engines are described that could be run in either pulsed or steady state modes. In the pulsed mode nuclear energy is released by fissioning of uranium or plutonium in a supercritical assembly of fuel and working gas. In a steady state mode a fuel-gas mixture is injected into a magnetic nozzle where it is compressed into a critical state and produces energy. Engine performance is modeled using a code that calculates hydrodynamics, fission energy production, and neutron transport self-consistently. Results are given demonstrating a large negative temperature coefficient that produces self-shutoff or control of energy production. Reduced fission product inventory and the self-shutoff provide inherent nuclear safety. It is expected that nuclear engine reactor units could be scaled up from about 100 MW_e.

18566 (WHC-SA–1011) **Seismic analysis of a sodium-filled tank.** Chen, W.W. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910602–66: 1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, San Diego, CA (United States), 23-27 Jun 1991). Order Number DE92012200. Source: OSTI; NTIS; GPO Dep.

An analysis is described to determine the seismically-induced hydrodynamic responses such as sloshing natural frequency, sloshing pressure, and impulse pressure for a top-supported sodium-filled cylindrical tank. The vibrational effects of an internally immersed pipe on the fluid responses also are considered. Reaction forces from both low frequency fluid modes and high frequency tank modes are combined to determine the required tank support loads. Results from the analysis of the sodium-filled tank model have been compared with the results using the same three-dimensional (3-D) model with lumped fluid mass at evenly distributed shell nodes. The results from the lumped-mass model gave conservative support loads. The analysis used the ANSYS finite-element computer code. The results of the analyses indicate that no sodium sloshing modes exist that may interact with the shell mode. Both the immersed pipe and the tank shell behave in the rigid frequency range.

18567 (WSRC-MS–91-033) **An analytical assessment of the chemical form of fission products during postulated severe accidents in the SRS production reactors.** Adams, J.P. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-910252–3: 1991 American Nuclear Society (ANS) meeting, Albuquerque, NM (United States), 24-28 Feb 1991). Order Number DE92009979. Source: OSTI; NTIS; INIS; GPO Dep.

An analysis has been performed to determine the principal chemical forms for the structural and fission product elements during a postulated severe core damage accident in tritium powered core in the Savannah River Site (SRS) reactors. These reactors are powered with UAl_x fuel and are used for the production of weapons materials. Six core elements, cesium, iodine, tellurium, strontium, barium, and lithium, were emphasized in this analysis. Other elements also included were aluminum, hydrogen, oxygen, uranium, molybdenum, silicon, zirconium, magnesium, iron, chromium, nickel, cadmium, zinc, cooper, manganese, nitrogen, and argon. The masses of each of the constituents used in the analyses were based on end-or-core life masses for the structural and fission product elements and on core gas volume for steam, N, and Ar. A chemical equilibrium analysis was performed using the Facility for Analysis of Chemical Thermodynamics (FACT) computer code at three temperatures (800, 1100, 1400 K) and two pressures (1 and 10 atmospheres). These temperatures and pressures are typical for postulated severe core accidents in the ATR.

18568 (WSRC-MS–91-270) **Overview of the Savannah River reactor surveillance program.** Sindelar, R.L.; Thomas, J.K.; Baumann, N.P. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920631–29: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92013195. Source: OSTI; NTIS; GPO Dep.

Preliminary radiation effects studies, now nearing completion, are based upon short-term irradiations in the High Flux Isotope Reactor (HFIR) and University of Buffalo Reactor (UBR). The purpose of these studies is to assess the impact of radiation effects on the performance and service life of Savannah River Site (SRS) reactor components. The SRS reactor surveillance program was simultaneously established in order to validate the results of these short-term irradiations under conditions more applicable to the SRS reactor components. The main conditions of interest include: temperature, moderator chemistry and neutron spectrum. The materials employed in both the surveillance and short-term irradiation programs were taken from the SRS R-reactor process piping and included base, weld, and heat-effected zone metal samples in both the C-L and L-C orientations. Test specimen types include tensile, Charpy V-notch, compact tension, constant extension rate test, and wedge-opening-load. A program schedule has been established for the irradiation and testing of surveillance specimens. The surveillance capsules are currently undergoing irradiation near the center of the SRS K-rector core and will remain in this location until their total fast fluence is equal to the current maximum reactor tank wall exposure. The bulk of the specimens will then be moved to blanket capsules at the edge of the core in order to track the wall exposure. A small portion of the specimens will be removed and tested, and a third group of specimens will be removed from the central core position after they have accumulated a thermal fluence 50%

greater than the current maximum tank wall exposure. Specimen groups will be removed from the blanket capsules and tested periodically. Additional capsules may be inserted in order to generate flow fluence or high thermal to fast flux ratio data. 17 refs.

18569 (WSRC-MS--91-451) **Air-water hydraulics modeling for a Mark-22 fuel assembly with RELAP5: Part 2.** Caraher, D.L. (Engineering Software Consulting (United States)). Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9111124--6-Pt.2: 1991 RELAP5/TRAC-B international users seminar, Baton Rouge, LA (United States), 4-8 Nov 1991). Order Number DE92010623. Source: OSTI; NTIS; GPO Dep.

The RELAP5/MOD2.5 computer program is being used to simulate hypothetical loss-of-coolant accidents in the Savannah River Site (SRS) production reactors. Because of their unique geometry and thermal-hydraulic design these reactors pose a significant challenge to the simulation capability of RELAP5. This paper focuses on one aspect of the LOCA simulations, air-water flow through the fuel assemblies. Improvements to the RELAP5 code's treatment of wall friction and interfacial friction are described. 9 refs.

18570 (WSRC-MS--92-035) **Response of a Type III waste tank to hydrogen deflagration.** Gong, Chung; Jerrell, J.W.; Pelfrey, J.R.; Yau, W.W.F. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9205135--1: 1992 ABAQUS user's meeting, Newport, RI (United States), 27-29 May 1992). Order Number DE92011002. Source: OSTI; NTIS; INIS; GPO Dep.

The type III waste tank is built with ASTM A516 Grade 70 steel shells in the shape of a torus with a central concrete core. The tank is buried underground and covered with a four foot thick reinforced concrete slab. The tank is enriched by 2.5 foot thick reinforced concrete wall. Between the tank surface and the wall there is a 2.5 foot annular space. The tank itself is called the "primary liner." The interior surface of the concrete wall is line with steel plates, called the "secondary liner." The base of the tank rests on a concrete mat. Underneath the mat the secondary liner extends from the wall to the central column surfaces. The bottom liner is attached to the reinforced concrete foundation. Based on the conditions that the tank is filled with liquid wastes to 50% of the design capacity, and that the accumulation of hydrogen becomes 20% inside its free board, the resulting deflagration would cause an overpressure of 100 psig in the tank [Wallace and Yau, 1986]. The task of this analysis is to simulate the "hydrogen deflagration" scenario in the Type III Waste Tank complex. During the deflagration, the stresses in the steel tank would be expected to exceed the elastic limit of the steel and the tank would then undergo large deformation. The concrete roof slab could be fractured by the expansion of the tank. The central concrete column would start to exhibit large deformation first. All the structural members in the system are expected to interact drastically during the deflagration.

18571 (WSRC-MS--92-052) **The effects of friction on component dynamic response.** Bryan, B.J.; Flanders, H.E. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920631--18: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92011099. Source: OSTI; NTIS; GPO Dep.

Friction is often used to components and piping from moving relative to building anchorages and other components. It is common analytical practice to address frictional constraints by either neglecting them and allowing unrestrained motion or by fixing them and not allowing any motion. An evaluation of the dynamic response of a component with frictional constraint is presented. Simplified component models with both fixed and fractionally constrained boundary conditions are analyzed with sinusoidal harmonic and recorded earthquake time history input excitations. The harmonic forcing results are compared with closed form solutions to establish accuracy of the methods and to relate frictional energy dissipation to equivalent viscous damping. The results of the earthquake excitations are compared and related to the overall system response. 2 refs.

18572 (WSRC-MS--92-066) **The development of code inservice inspection (ISI) requirements for Low Temperature Heavy Water Reactors (LTHWR).** Cowfer, C.D. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920631--23: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92013176. Source: OSTI; NTIS; GPO Dep.

DOE Savannah River Field office requested that the American Society of Mechanical Engineers (ASME) develop rules for inservice inspection (ISI) of Savannah River Site (SRS) Low Temperature Heavy Water Reactors (LTHWR's) in January 1990. The request is part of the SRS Reactor Safety Improvement Program (RSIP). RSIP will implement an ASME B & PV Code Section XI based ISI program after restart of K Reactor. The establishment of a Code based ISI program at SRS will affect a transition from a standing log which scheduled inspections to a program structured to commercial reactor standards. The SRS standing log for periodic inspection of equipment was initiated in the early 1970's, approximately the same time Section XI ISI programs were initiated at commercial reactors. The information contained in this article was developed during the course of work under Contract Number AC09-89SR18035 with the US Department of Energy.

18573 (WSRC-MS--92-124) **System response to relay chatter.** Antaki, G.A.; Radder, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920631--21: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92013076. Source: OSTI; NTIS; GPO Dep.

An important aspect of the qualification of safety related systems, is the assessment of the possibility and consequences of seismic or vibration induced relay chatter. The current rules, contained in ANSI/IEEE C37.98 and the SQUG GIP, consider as seismic induced "failure" of a relay, a chatter contact in excess of 2 milliseconds. While this rule is clear in defining "failure" of single relay, the definition of "failure" becomes more problematic when we consider the alignment of an assembly of relays in series or parallel, and the effects of chatter on the function of the system in which the relays are mounted. In this paper, we report a method, based on system test and probabilities analysis, used to assess "failure" by relay chatter in an assembly of relays which control an electric motor. 2 refs.

18574 (WSRC-RP--92-222) **Examination of cadmium safety rod thermal test specimens and failure mechanism evaluation.** Thomas, J.K.; Peacock, H.B.; Iyer, N.C. Westinghouse Savannah River Co., Aiken, SC (United States). Jan 1992. 194p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013221. Source: OSTI; NTIS; INIS; GPO Dep.

The reactor safety rods may be subjected to high temperatures due to gamma heating after the core coolant level has dropped during the ECS phase of a hypothetical LOCA event. Accordingly, an experimental cadmium safety rod testing subtask was established as part of a task to address the response of reactor core components to this accident. Companion reports describe the experiments and a structural evaluation (finite element analysis) of the safety rod. This report deals primarily with the examination of the test specimens, evaluation of possible failure mechanisms, and confirmatory separate effects experiments. It is concluded that the failures observed in the cadmium safety rod thermal tests which occurred at low temperature (T < 600°C) with slow thermal ramp rates (slow cladding strain rates) resulted from localized dissolution of the stainless steel cladding by the cadmium/aluminum solution and subsequent ductility exhaustion and rupture. The slow thermal ramp rate is believed to be the root cause for the failures; specifically, the slow ramp rate led to localized cladding shear deformation which ruptured the protective oxide film on the cladding inner surface and allowed dissolution to initiate. The test results and proposed failure mechanism support the conclusion that the rods would not fail below 500°C even at slow ramp rates. The safety rod thermal test specimen failures which occurred at high temperature ($T > 800°C$) with fast thermal ramp rates are concluded to be mechanical in nature without significant environmental degradation. Based on these tests, tasks were initiated to design and manufacture B_4C safety rods to replace the cadmium safety rods. The B_4C safety rods have been manufactured at this time and it is currently planned to charge them to the reactor in the near future. 60 refs.

18575 (WSRC-TR-91-40-12) **Minutes: SRL Criticality and Accountability Review Committee.** Gerrard, P.B.; Ha, B.C.; Jolly, L.; Key, F.; Rudisill, T.S.; Trumble, E.F.; Griffin, J.C. Westinghouse Savannah River Co., Aiken, SC (United States). 2 Jan 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013113. Source: OSTI; NTIS; INIS; GPO Dep.

Various aspects safety procedures concerning the handling of fissile materials at Savannah river plant are presented in these (12-16-91) meeting minutes. Criticality control procedures, inconsistencies in mass limit forms, and nuclear incident monitors, etc. are briefly discussed. (GHH)

18576 (WSRC-TR-91-0557) **Summary report on four foot septifoil cooling experiment.** Randolph, H.W.; Collins, S.L.; Verebelyi, D.T.; Foti, D.J. Westinghouse Savannah River Co., Aiken, SC (United States). Oct 1991. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013209. Source: OSTI; NTIS; GPO Dep.

Cooling parameters for some of the SRS reactor internal components are computed using the Transient Reactor Analysis Code, "TRAC." In order to benchmark the code, the Safety Analysis Group of SRL requested an experiment to provide measurements of cooling parameters in a well defined physical system utilizing SRS reactor component(s). The experiment selected included a short length of septifoil with both top and bottom fittings containing five simulated control rods in an "unseated" configuration. Power level to be supplied to the rods was targeted at 2.5 kilowatts per foot. The septifoil segment was to be operated with no forced flow in order to evaluate thermal-hydraulic cooling. Parameters to be measured for comparison with code predictions were basic cooling phenomena, incidence of film boiling, thermal-hydraulic flow rate, pressure rise, and ratio of heat transfer through the wall of the assembly vs heat transfer to axial water flow through the assembly. Experimental apparatus was designed and assembled incorporating five simulated control rods four feet long, joule heated inside a five foot length of type "Q" septifoil. Water at 70 C was fed independently to the bottom inlet and along the outside of the septifoil. Water flowing along the outside of the septifoil was in confined flow and provided calorimetry to measure power flow through the septifoil housing. A shadowgraph technique was developed and used to monitor unforced flow of water pumped thermal-hydraulically through the septifoil. Electrical power of 10,000 to 70,000 watts was fed to the simulated rods from a dc power supply. Computer data acquisition was accomplished using "LabView" software programmed to match the configuration of the experiment along with scanning digital voltmeters and requisite signal sensors. Video camcorders were used to provide video records of six areas of the experiment.

18577 (WSRC-TR-91-615) **Substitute safety rods: Physics of operation and irradiation.** Baumann, N.P. Westinghouse Savannah River Co., Aiken, SC (United States). 18 Nov 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92012443. Source: OSTI; NTIS; INIS; GPO Dep.

Under certain assumed accidents, an SRS reactor may lose most of its bulk moderator while maintaining flow to fuel assemblies. If this occurs immediately after operation at power, components normally dependent on convective heat transfer to the moderator will heat up with the possibility of melting that component. One component at risk is the currently used cadmium safety rod. A substitute safety rod consisting solely of sintered B_4C and stainless steel has been designed which is capable of withstanding much higher temperatures. This memorandum provides the physics basis for the adequacy of the rod for reactor shutdown and provides a set of criteria for acceptance in the NTG tests. This memorandum provides physics data for other aspects of operation. These include: Heat production and helium production, along with related phenomena, resulting from inadvertent irradiation at power. Gamma heat input under drained tank conditions. An equivalent rod design suitable for charge design and safety analyses. Degradation under normal operation. Thermal flux ripple in adjacent fuel due to axial striping of alternate B_4C and steel pellets. Possible effect on safety analyses. Safety rod withdrawal during reactor startup.

24 POWER TRANSMISSION AND DISTRIBUTION

Refer also to citation(s) 18633

2401 Power Systems

Refer also to citation(s) 18727

18578 (ETDE-IT-92-29) **Enhanced distribution automation system based on new communications technology at ENEL.** Comellini, E.; Gargiuli, R.; Gelli, G.; Tonon, R.; Mirandola, P. Ente Nazionale per l'Energia Elettrica, Milan (Italy). 1991. 25p. (CONF-9111217-4: L'Europa dei teleservizi tecnici: le esperienze dei gestori e le prospettive di sviluppo, Rome (Italy), 21-22 Nov 1991). Order Number DE92506245. Source: OSTI; NTIS (US Sales Only); INIS.

On the basis of extensive research aimed at the assessment of the feasibility of a cost effective two-way telecommunications system, and of the experience gained during the eighties in the field of remote control of the primary distribution network where new digital techniques were introduced, and in the field of metering apparatus, where about 7,000 HV and MV customers were equipped with Ferraris meters associated with electronic devices for the application of multirate tariffs, ENEL (Italian National Electricity Board) has designed a new distribution automation system aimed at: remote control of the MV distribution network, and MV and LV customer meter service automation. This report describes the key choices that determined the architecture of the new system and the most important features of its main components, in view of: an improvement of energy usage efficiency, better service to the customers, as well as, increased simplicity and transparency in customer relationships.

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 18584

18579 (ETDE-IT-92-26) **Electrical network of Turin (Italy) tramway: Computer-aided design analysis.** Bottauscio, O.; Crotti, G.; Farina, G.; Tartaglia, M.; Vacca, A. Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin (Italy); Politecnico di Torino, Turin (Italy). 1990. 6p. (In Italian). (CONF-9010484-1: 91. AEI annual meeting, Turin (Italy), Oct 1990). Order Number DE92506242. Source: OSTI; NTIS (US Sales Only).

The modernization of the Turin (Italy) tramway, through the adoption of high performance electronically regulated electric engines, required an accurate check of the existing tramway electrical supply system. To accomplish this task, a computer-aided design analysis method was employed in which the network was represented by its various elements, i.e., ac to dc conversion substations, power supply cables, contact and engine wires, etc., distributed in such a way as to suit a set of hypothetical traffic conditions. The network analysis code provided the node voltages and opposite end currents, thus allowing a rapid check of the system. The next step involved the modification of the network structure and parameters to satisfy the constraints imposed by the elements constituting the network itself and the transport service requirements.

18580 (ETDE-IT-92-33) **SELF expert system for management of power network operating codes.** Cicoria, R. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca

Elettrica. Dec 1991. 6p. (In Italian). Order Number DE92506260. Source: OSTI; NTIS (US Sales Only).

The study of the operation of high voltage electric utility networks, e.g., the 400 kV ENEL (Italian National Electricity Board) power distribution system, is usually carried out through the use of computerized programs which do various network calculations relative to load distributions, short-circuit currents, reliability, etc. The analysis of the results of such programs, their systematic use and linkage, the arrangement of input data, etc., are tasks which are carried out on a heuristic basis developed over the years by the experienced operator. This paper describes an ENEL experiment involving the development of an expert system called SELF which, incorporating a typical expert's heuristic set of rules, provides a useful guide to the performance of network calculations and to the management of the relative computer codes. The system, developed in COMMON LISP, provides adequate justifications for all its suggestions, and thus allows the operator to verify the logic employed, and to widen or make adjustments to the knowledge base. The results after one year of testing are reported here.

18581 (ETDE-IT--92-37) **Expert systems for management of power network operating codes.** Baggini, L.; Cicoria, R.; Pessi, E.; Tornielli, G. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica; Centro Informazioni Studi Esperienze (CISE), Milan (Italy). Dec 1991. 8p. (In Italian). Order Number DE92506263. Source: OSTI; NTIS (US Sales Only).

The study of the operation of high voltage electric utility networks, e.g., the 400 kV ENEL (Italian National Electricity Board) power distribution system, is usually carried out through the use of computerized programs which do various network calculations relative to load distributions, short-circuit currents, reliability, etc. The analysis of the results of such programs, their systematic use and linkage, the arrangement of input data, etc., are tasks which are carried out on a heuristic basis developed over the years by the experienced operator. This paper describes an ENEL experiment involving the development of an expert system which, incorporating a typical expert's heuristic set of rules, provides a useful guide to the performance of network calculations and to the management of the relative computer codes.

18582 (NEI-NO--208) **Power electronics as source for disturbances in power distribution systems: Analysis and assessment of noise level.** Stroemsvik, T. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Aug 1990 204p. (In Norwegian). Order Number DE92506545. Source: OSTI; NTIS (US Sales Only).

The electrical power is supplied to consumers as a pure sinewave voltage at power frequency. The electrical current drawn by the consumers' apparatus ought to be a pure sinewave current at the same frequency. Some comsumers possess, however, apparatus whose impedances are not constant during a period of the power frequency. The current drawn from the power supply then deviates from perfect sinusoids. The distorted current runs through impedances located between the consumers and the idealized voltage source of the system, causing non-sinusoids voltage drops. The voltage at power system nodes becomes distorted with a content of higher frequency components (harmonics) in addition to the fundamental. Power electronic convertors are equipment with a discontinous variable impedance, and a growing amount of electrical power is regulated by such equipment. This thesis describes computing methods, measuring principles and yielding standards to analyze distortions from all kind of power electronic convertors connected to the power system. Two different methods are discussed: In the frequency domain method the disturbing apparatus (the convertor) is represented as an ideal current or voltage source for harmonic currents or voltages. This representation is based upon Fourier-series theory regarding a non-linear impedance as a harmonic current or voltage source. In the time domain method the electrical equivalent of the power electronic convertor consists of the non-linear (time-varying) elements (thyristor, diodes and switches) in addition to the ordinary linear elements of the circuit. The time-varying elements are activated during a period of the power frequency, thus altering the circuit impedance. 84 refs., 129 figs., 19 tabs.

2403 Power Transmission Lines and Cables

Refer also to citation(s) 18579

18583 (ETDE-IT--92-35) **HVAC transmission line surface insulation in marine environments: Sizing and design based on tests and field experience.** Marinoni, F.; Porrino, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica. Jul 1991. 9p. (In Italian). Order Number DE92506262. Source: OSTI; NTIS (US Sales Only).

Marine environmental contamination of transmission line insulators represents a significant problem to ENEL (Italian National Electricity Board) due to the high concentration of urban and industrial areas along Italy's coastlines. ENEL recognizes that in designing against intense salt fog conditions, insulator sizing plays an important role. Optimization tends towards the minimization of the failure rate with the contemporaneous avoidance of oversizing, all at an acceptable risk of discharge. This paper reports on how ENEL has established, through numerous laboratory tests and in-field inspections in which measurements were made of insulator surface conductivity, contamination severity distribution curves for use in the optimum design and sizing of transmission line surface insulation.

2404 Health and Safety

18584 (ETDE-IT--92-32) **HVAC overvoltage protection equipment: Characteristics, problematics and surge arrester choosing criteria.** Bargigia, A.; de Nigris, M. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica; Centro Elettrotecnico Sperimentale Italiano (CESI), Milan (Italy). Dec 1991. 54p. (In Italian). (CONF-9201104--1: Giornata di studio AEI su 'Protezione da sovratensioni delle stazioni AT', Genoa (Italy), 29 Jan 1992). Order Number DE92506259. Source: OSTI; NTIS (US Sales Only).

The availability of reliable protection equipment for the reduction of the severity of effects from overvoltages is of fundamental importance, in terms of technical and economic aspects, to the designer of power stations, in that, the choice of station component isolation levels is essentially carried out with the aim of containing the overvoltages which may arise in the station itself. In analyzing the design and performance characteristics of suitable protection equipment, this paper illustrates how zinc oxide surge arresters constitute an important innovation.

2405 Environmental Aspects

Refer also to citation(s) 18664

18585 (DOE/EA--0598) **Canby Area Service Project substation and associated transmission line: Environmental Assessment.** USDOE Bonneville Power Administration, Portland, OR (United States). Feb 1992. 123p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012637. Source: OSTI; NTIS; INIS; GPO Dep.

Bonneville Power Administration (BPA) provides power to Surprise Valley Electrification Corporation (SVEC) in Modoc County, California. BPA uses PacificCorp's substation and transmission facilities between Alturas and Canby, California to transfer power to SVEC's Canby Substation. In the next year, SVEC expects increased industrial, agricultural, and residential electric loads on their 69-kV transmission system south of Canby. SVEC's substation can accommodate only about 10 percent of the expected additional electric load. BPA's proposed action is intended to meet SVEC's increasing electric load. BPA proposes to meet SVEC's increasing energy load by tapping into BPA's existing BPA Malin-Warner 230-kV transmission line, and building an 7.9-mile transmission line to a new BPA substation. BPA proposes to build the new substation next to the west side of SVEC's Canby Substation (Figure 1). This new substation will allow SVEC to move the additional power over their existing transmission or distribution lines. This report is the environmental assessment of the potential impact of the proposed project. The assessment determined that no "environmental impact statement" is not required.

2406 Legislation and Regulations

18586 (NUTEK-B–91-6) **A changing power market: From monopoly to competition.** NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). Nov 1991. 198p. (In Swedish). Order Number DE92506585. Source: OSTI; NTIS (US Sales Only).

The possibilities to open the Swedish electricity market for competition have been investigated in a study commissioned by the government. The study is the first one to penetrate most aspects of the Swedish power market. However, the report does not give an actual program for the reformations. The main conclusion of the study is that the electric power transmission lines must be kept open for all producers, not only the owners. A possible system of rules for the operation of such open networks are presented in the report. The main transmission lines should be owned and operated by a government public utility to assure openness and impartiality. Several changes to Swedish law must be made to accomodate for the suggested new structures. The changes are reviewed in the report.

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 18578

25 ENERGY STORAGE

Refer also to citation(s) 18633

2506 Thermal

Refer also to citation(s) 18275, 18645

18587 (LUTMDN-TMVK–3146-1-25-92) **On hot water storage in district heating subscriber stations: Storage tank modelling.** Winberg, J. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Jan 1992. 21p. Order Number DE92506573. Source: OSTI; NTIS (US Sales Only).

The report presents two simple models of a stratified hot water storage tank. Both are one-dimensional models of the thermal stratification in the tank water. Temperature variations in horizontal direction is neglected, i.e. only the vertical water temperature distribution is calculated. Comparison is made to a 152 l experimental storage tank. The first model has heat loss terms added, which describe the heat losses to the air around the tank. Some parameters in the model are adjusted by a parameter estimation procedure through a state-space formulation of the model. This is done by means of Kalman-filtering the model and experimental data. The second model is found in literature and is analytical. It has no heat losses, but takes some of the tank's wall heat capacity into account. Empirical parameters for this model have to be given better values in further work. 14 refs., 12 figs.

18588 (LUTMDN-TMVK–7009-1-76-92) **On hot water storage in district heating subscriber stations: System measurements.** Winberg, J. Lund Univ. (Sweden). Dept. of Heat and Power Engineering. Jan 1992. 71p. Order Number DE92506574. Source: OSTI; NTIS (US Sales Only).

The thesis presents laboratory measurements of district heating subscriber stations. Thermodynamic performance characteristics are derived for an experimental subscriber station with a hot water storage tank and an external heat exchanger, but there are also characteristic results for the tank itself. The performance is presented in terms of return temperature, hot water capacity, quality of hot water temperature control and size of heat losses. The laboratory test objects are equipped with accurate measuring devices and a computer program is developed to collect data, to simulate loads of hot water and radiator heat realistically and to control the test rig. A survey is made of several standardized hot water draw-off sequences found in the literature, ending up with adopting the one given in the German DIN-code. Radiator load is simulated by means of a mathematical model and a special load module at the laboratory, to achieve a reproducible and dynamical radiator circuit. Some use is made of simple theoretical models of heat exchangers and storage tanks, when attempting to generalize the conclusions derived from the measurements.

18589 (NYSERDA–92-1) **Monitoring for thermal storage demonstration: Final report.** Carlson, S.W. (Fleming Group, Washington, DC (United States)). New York State Energy Research and Development Authority, Albany, NY (United States); Fleming Group, Washington, DC (United States). Oct 1991. 73p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; INIS; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

Detailed field monitoring of electric thermal storage (ETS) space heating and cooling systems were conducted to evaluate the appropriateness of these systems in the State of New York. This study collected detailed performance data on four ETS systems: pressurized hot water storage, non-pressurized hot water storage, sub-slab earth thermal heat storage and ice-on-coil cool storage. The energy consumption of the plant and secondary/parasitic equipment along with the system efficiency and storage losses were quantified over a heating and cooling season. Operating experiences that affected the system performance were also summarized. Each system was compared to a typical non-storage system on an electric energy use, electricity demand profile and economic basis. While the study shows that nearly all of a building's on-peak heating and/or cooling energy can be shifted economically to the off-peak periods, it also found that total system energy consumption increased by 10% to 25%, due to additional parasitic energy requirements, less efficient operating conditions and thermal losses from the storage media.

18590 (TKK-F–A623) **Thermal analyses of aquifer energy storage systems.** Kangas, M.T.; Lund, P.D. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1991. 93p. Order Number DE92506508. Source: OSTI; NTIS (US Sales Only).

The different time dependence of energy production and consumption often complicates the design of an effective and economical energy system. This mismatch can be reduced by storing energy. Energy production systems can then be designed more independently, taking into account technical, economical as well as environmental factors. The need for storage is pronounced with renewable energy sources, such as solar or natural heat. Also, large cogeneration systems may benefit from storage. In this study, a 3-dimensional computer simulation model for aquifer thermal energy storage systems has been presented. The model employs upwind finite difference method to simulate the flow of water and heat in an aquifer. Separate submodels for energy production and consumption are also included, enabling the simulation of total energy systems. Possible subsystems include e.g. solar collectors, heat pump, buffer storage, and heat load. Heat source with an arbitrary input pattern can also be defined. Subsystems can be connected in miscellanous ways to form the desired energy system. The purpose of the study is to use the system model to evaluate the thermal performance of different aquifer based energy systems. On the basis of the simulations, some general guidelines for the thermal design of these systems are given.

2508 Chemical

Refer also to citation(s) 18253, 18645

2509 Batteries

Refer also to citation(s) 18275, 18680, 18805

18591 **Alkali metal energy conversion device and method of construction.** Bindin, P.J.; McLachlan, S.; Bell, C.O.; Sands, G.; Ball, R.A. To Chloride Silent Power Ltd. (UK). 2 Nov 1991. Filed date 2 May 1990. Canada Patent patent application 2015961. 20p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

The cathode region of a sodium-sulfur cell has hitherto sometimes been sealed by a thin metal member welded at its outer periphery to the metal casing and at its inner periphery to the alpha alumina lid of the electrolyte. The welding operation damages the essential protective coating of the thin metal member. An alternative method of constructing such a cell is disclosed in which the cathode region is sealed with a thin metal member secured to a concentric outer thicker metal member. The thin member is sealed to the lid by thermocompression bonding and the thicker member is bonded to the casing. The thickness of the outer member eliminates the need for a protective coating so that the combined seal has greater integrity than previously known seals. 3 figs.

2520 Health and Safety

Refer also to citation(s) 17878

29 ENERGY PLANNING AND POLICY

18592 (AFME–89-04-0019-1) **Optimal and/or adaptive control of energy systems in building.** Vinot, B.; d'Acremont, E.; Hutter, E. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 131p. (In French). Order Number DE92792640. Source: OSTI; NTIS (US Sales Only).

A modular optimal control model, including a large set of parameters, is carried out; its principles are similar to those developed by GER IRCOSE fundamental research (deterministic optimal control solved by a gradient method). The coupling of optimal controller and an identification algorithmic procedure were performed; the concept of adaptative control simulation was tested and validated within the CSTbat simulation software. A methodology for adaptative control analysis was developed and applied to an electrical heating device.

18593 (AFME–89-04-0019-2) **Energy system control: approach through knowledge based systems.** Vinot, B. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 137p. (In French). Order Number DE92792648. Source: OSTI; NTIS (US Sales Only).

Applied to energy management and system control, the main benefits from artificial intelligence are: improvement of system behaviour, increased robustness compared to numerical methods, adaptability to installations and users, easy knowledge up-dating, accuracy and preservation of the know-how through a clear expression and accessibility of the knowledge. Problems arise from real-time temporal constraints for highly dynamic systems and from complexity of the knowledge related to energy system control.

2901 Energy Analysis and Modeling

Refer also to citation(s) 18649, 18715

18594 (CONF-9001171–, pp. 13-48) **Energy conversion processes - possibilities and evaluations.** Keller, J.U. (Siegen Univ. (Germany)). Daimler-Benz AG, Berlin (Germany). Forschung Technikumfeld. Feb 1991. 125p. (In German). From Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990. In *Potential and assessment of alternative energy conversion processes. Sub-project B: Energy conversion processes - potential and assessment. Proceedings.* Order Number DE92515841. Source: OSTI; NTIS (US Sales Only).

Possibilities for alternative energy conversion technologies are discussed with the aim to gain savings in fossil, carbon bound primary energies (CO_2-problem). The essential possibilities for this seem to be the coupled production of efficient energies, for example cogeneration for nuclear power stations, combined storage processes, energy integration, increased waste heat utilization and utilization of solar heat for hot tap water supply. (orig.).

18595 (NEI-DK–811) **14. Urban data management symposium. Vol 1.** Rasmussen, J. (ed.). Kommunedata, Odense (Denmark). May 1991 356p. (CONF-9105335–Vol.1: 14. Urban data management symposium, Odense (Denmark), 29-31 May 1991). Order Number DE92506377. Source: OSTI; NTIS (US Sales Only).

Papers presented at a conference on urban data management describe a variety of coordinated information systems that can be used as a basis for planning, and decision making in many urban contexts, and for control and monitoring purposes, for example with regard to pollution. (AB).

18596 (NEI-DK–812) **14. Urban data management symposium. Vol 2.** Rasmussen, J. (ed.). Kommunedata, Odense (Denmark). May 1991 342p. (CONF-9105335–Vol.2: 14. Urban data management symposium, Odense (Denmark), 29-31 May 1991). Order Number DE92506381. Source: OSTI; NTIS (US Sales Only).

Papers presented at a conference on urban data management describe a variety of coordinated information systems that can be used as a basis for planning, and decision making in many urban contexts, and for control and monitoring purposes, for example with regard to pollution. (AB).

2902 Economics and Sociology

Refer also to citation(s) 17918, 18621, 18648, 18660, 18665, 18719, 18744, 19439

18597 (ANL/CP–74094) **A forecasting model of gaming revenues in Clark County, Nevada.** Edwards, B. (Argonne National Lab., IL (United States)); Bando, A.; Bassett, G.; Rosen, A.; Carlson, J.; Meenan, C. Argonne National Lab., IL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920430–72: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92010900. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the Western Area Gaining and Economic Response Simulator (WAGERS), a forecasting model that emphasizes the role of the gaming industry in Clark County, Nevada. It is designed to generate forecasts of gaming revenues in Clark County, whose regional economy is dominated by the gaming industry, an identify the exogenous variables that affect gaming revenues. This model will provide baseline forecasts of Clark County gaming revenues in order to assess changes in gaming related economic activity resulting from future events like the siting of a permanent high-level radioactive waste repository at Yucca Mountain.

18598 (CMI-R–91/A30015) **Positive feedback economics and the competition between "hard" and "soft" energy supplies.** Moxnes, E. Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway). Sep 1991. 18p. Order Number DE92506532. Source: OSTI; NTIS (US Sales Only).

Socio-economic evaluations of energy saving technologies.

The report concerns a project dealing with socio-economic evaluations of energy saving technologies. The social and environmental benign energy technologies are termed as "hard"- and "soft"-supplies according to the Lovin terminology. In the report there is looked beyond estimates of current costs, explicitly dealing with positive feedback through learning. This perspective helps explain at least some of the historical cost advantage of hard technologies, and it provides new insights into the long-term consequences of energy technologies. 23 refs., 5 figs.

18599 (DOE/IG–0306) **Audit of the internal controls over the processing of oil overcharge refunds.** USDOE Office of Inspector General, Washington, DC (United States). Capital Regional Audit Office. 31 Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

This report is on internal controls over the processing of oil overcharge refunds. The Office of Hearings and Appeals administers the distribution of refunds to parties that were overcharged during the period of petroleum price controls. The refund process was initiated in 1979. As of September 30, 1991, Hearings and Appeals had received over 200,000 applications for refunds. It had granted refunds with a total value of more than 600 million on about 160,000 applications, with 26,636 applications pending. The objectie of the audit was to evaluate the adequacy of Hearings and Appeals' internal controls over refund practices and procedures, specifically those used to ensure that claims approved were complete, systematically processed, and properly distributed.

18600 (ENEA-RTI-DS-91-03) **International distribution of industrial activity as determined by energy factors: Trend analysis.** Reina, G. ENEA, Rome (Italy). Direzione Studi. Dec 1991. 154p. (In Italian). (RTI/DS-91-03). Order Number DE92506221. Source: OSTI; NTIS (US Sales Only).

This examination of international trends in the distribution of industrial activity puts heavy emphasis on the socio-economic impacts of the energy policies formulated by the industrialized countries in response to the strategies taken by the petroleum industry and international trade dynamics within the energy sector. Through a global analysis of post WW 2 trends in industrial activity, economic growth forecasts are developed for the established industrialized countries, i.e., the US, Japan, European Communities, as well as, for the new emerging industrialized nations such as Korea.

18601 (KTM/E-D-198) **Multidimensionality of risk: Risks in environmental impact assessment of energy production.** Raivola, P. (Turun yliopisto (Finland). Satakunnan ympaeristoentutkimuskeskus); Kamppinen, M. Ministry of Trade and Industry, Helsinki (Finland). Energy Dept. 1991. 39p. (In Finnish). Project KTM-116/881/89. Order Number DE92506484. Source: OSTI; NTIS (US Sales Only).

This report reviews the prospect of social sciences and humanities in improving assessment of environmental impacts and risks. The report emphasizes the common sense perspective on risks. However, at the same time the distinction between the layman and the expert is de-emphasized. In the opening chapter risks are described as multidimensional, thus including social and psychological aspects. Prominent studies in psychology have shown that the ways people solve problems of probability does not follow the teachings of high-school mathematics, but instead is based on different heuristics. In fact, the whole of the decision making process is based on 'small decisions', concerning what is relevant, and should be included for further elaborations. Not all of these choices are conscious, either. Risk profiles, dimensional maps of risk perception, and cognitive models in general, are suitable tools for describing this process. After the psycholgical turn theories that construe decision making as social activity are introduced. Cognitive models of risks are created and changed within a social environment. Descriptive case-studies are summarized, and the social significance of risk perceptions is evaluated. The report is concluded by setting the previous chapters in the context of multidimensional Environmental Impact Assessment Cognitive and social scientific models are argued to benefit EIA in two ways: in the identification of relevant risks and in the estimation of impacts. The models give grounds for reasoned prediction of social impacts - thus supporting rational decision making. However, they do not provide the political decision maker with an excuse to avoid his/her responsibility.

18602 (UCRL-JC-109004) **Low-cost energy production: The responsibility of the developed countries toward the less-developed.** Oversby, V.M. Lawrence Livermore National Lab., CA (United States). Oct 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9110127-3: Conference on global climate change: its mitigation through improved production and utilization of energy, Los Alamos, NM (United States), 21-24 Oct 1991). Order Number DE92011534. Source: OSTI; NTIS; GPO Dep.

In recent years, the world has begun to develop an awareness of the environmental costs of economic expansion and development. The most widely recognized problems include depletion of the ozone layer, the effects of toxic chemicals on soils, groundwater, and wildlife, and the danger of global climate change through the accumulation of "greenhouse" gases in the atmosphere. In one area, that of ozone depletion, the nations of the world were able to quickly reach a consensus and take action to try to slow, if not stop, the depletion. In the area of global climate change, the ability to reach a consensus is less likely. This is because the production of greenhouse gases is intimately linked to the production of energy, and increases in energy production in the developing nations of the world will be needed if they are to develop their economies and the standard of living for their peoples. It is also highly unlikely that the nations of the developed world will be willing to lower their standard of living in order to allow that of less developed countries to be raised. In my opinion, this dilemma presents a formidable challenge and a great opportunity for both the technical community and the policy makers in the developed nations.

18603 (VTT-TIED-1317) **Use of an expert system for energy cost calculations in the pulp and paper industry.** Viinikainen, S. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Laboratory); Malinen, H. Technical Research Centre of Finland, Espoo (Finland). Dec 1991. 49p. Order Number DE92506495. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper, an applicajon for the calculation of energy prices and product energy costs in the pulp and paper industry by using the Xi Plus expert system is presented. The use of expert systems in the energy field and also the Xi Plus expert system and its general features are also discussed. The application has been made after collecting data from several sources. It runs in an IBM AT compatible microcomputer therefore being easily used in mills. The name of the application is PRODUCT ENERGY COST. It has a three level structure: the mill level, the department level and the main equipment level. Currently, the mill level and, in the energy production area, the department level (power plant) and the equipment level (boilers, turbines) are used. The application consists of four knowledge base groups. Altogether there are 52 separate knowledge bases having 534 rules or demons. The knowledge base groups are: BASIC DATA, ENERGY USE, ENERGY PRODUCTION and ENERGY COSTS. The application can be used for various heat and electrical energy price calculations or for energy cost calculations for different pulp and paper products. In this study, the energy prices for kraft pulp, TMP, newsprint and fine paper in different operating conditions and the associated energy costs of the products are calculated. Also, in some cases a sensitivity analysis is done. The expert system is quite suitable for this type of calculation and the method could be further developed for specific industrial needs, e.g. to enhance the energy management systems.

2903 Environment, Health, and Safety

Refer also to citation(s) 18109, 18142, 18220, 18226, 18601, 18635, 18640, 18650, 18651, 18652, 18664, 18671, 18702, 18705, 18763, 18778, 19376, 19439, 19466, 19486, 19518, 19547, 19940

18604 (CONF-9110375-, pp. 165-168) **Study on wastes disposition policies and its political evaluation. (2).** Fukuoka, K. (Rissho University, Tokyo (Japan)); Oshitani, I. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

Wastes are themselves unnecessary substances and have zero or negative external effect or external cost to a market. These require rediscussions as to whether wastes disposition is in the domain of a market mechanism or in a public systems, taking its environmental influences into sight for its selection. This paper summarizes the wastes generation mechanisms and describes the targets of the wastes disposition policies and how the required expenses should be shared. Wastes disposition cost can be divided into monetary cost including that for wastes collection and transportation and disposition facility construction, and into nonmonetary cost including that for environmental destruction and health problems caused from wastes not being disposed of properly. The problem is how to internalize these expenses and those non-monetary costs in particular, and at what share the producers and consumers would take the burden. However, no definite evaluation criteria for this problem have yet been established. Desired presently is a shift of the policies to a management of wastes discharge suppression. 1 refs., 2 figs.

18605 (CONF-9110375–, pp. 169-172) **Analysis of social convenience cost generated from policies of resource recycling based on sorted wastes collection.** Yasuda, Y. (University of Tsukuba, Tsukuba (Japan)); Ninomiya, K.; Kasuga, M. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

An acute problem for autonomous organizations in Japan in managing their cleaning policies is to sort out and collect recyclable refuses at the collection stage to reduce quantity of refuses. In this study, an analysis of social convenience cost was carried out to evaluate the refuse recycling policies. Specifically, stochastic expressions were developed to estimate how the quantity of refuses to be disposed of would be changed (quantities of collection, incineration, incineration residues and recycled refuses) in implementing resource recovery activities. A case in the city of Yokohama was used to analyze how the cost of collection and disposition can be reduced as a result of resource recycling. A case in the city of Abiko was used to see the saving effect in resource energy cost. As a result, it was clarified that reduction in the refuse collection and disposition cost and resultant large reduction in refuse disposition cost can be expected as a result of adopting the policies of resource recycling based on the sorted wastes collection. It was also found that the use of reclaimed resources can bring about a large effect of saving the resource energy cost. 2 tabs.

18606 (CONF-9110375–, pp. 177-180) **Effectiveness and fairness in wastes disposition fee.** Ueda, K. (Kyoto University, Kyoto (Japan)). Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This paper discusses fee problems related to general industrial wastes and final treatment lands involving public organization. The wastes disposition fee should satisfy two conditions simultaneously: not disturbing the optimal distribution of resources and achieving the civil minimum requirement. Final disposition locations involving public organizations must be so selected that refuses are treated properly in a direction that refuse discharging business concerns will observe strictly the PPP (Polluters Pay Principle). In this sense, it would be difficult to realize the desired purpose unless the management of final disposition locations by public organizations must be carried out in combination with administration of the regulations on private disposition lands and illegal disposition. From these viewpoints, the public sector must be a designer or a coordinator of a wastes management system to control a series of process from the wastes generation to treatment and disposition under a predetermined purpose, before being a supplier of the wastes disposition service.

18607 (CONF-9112113–1) **Local/regional policies: Acting globally by thinking locally.** Hillsman, E.L. Oak Ridge National Lab., TN (United States). [1991]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Global climate change: linking energy, environment, economy, and equity; Washington, DC (United States); 5-6 Dec 1991. Order Number DE92011672. Source: OSTI; NTIS; INIS; GPO Dep.

Policies to reduce greenhouse gas emissions from present levels will require changes in local and regional decision making as well as decisions made at national and multinational scales. A number of cities and states have taken action to reduce emissions either directly or as a byproduct of solving local problems such as air quality. These initiatives represent a potential resource to be mobilized in national policy. A series of case studies is under way to understand the decision making involved and its implications, and to identify ways that national policy might support and benefit from local efforts. Preliminary results from the first of these case studies indicate that reductions in greenhouse gas emissions may be greater when set as a direct target than when resulting as a byproduct of other local problem solving.

18608 (CONF-9203121–1) **The regulations for radionuclides and chemicals in the environment.** Kocher, D.C. Oak Ridge National Lab., TN (United States). [1991]. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Pathway analysis and risk assessment for environmental compliance and dose reconstruction; Kiawah Island, SC (United States); 2-6 Mar 1992. Order Number DE92011047. Source: OSTI; NTIS; INIS; GPO Dep.

This presentation detail information on current and proposed standards, recommendations, and guidances for limiting routine and accidental radiation exposures of the public. It also reviews certain laws and regulations intended primarily for limiting exposures of the public to non-radioactive hazardous materials. Limits on risk to the public embodied in laws and regulations are emphasized. It considers the only basis for comparing potential impacts from exposure to radionuclides and other hazardous materials.

18609 (DOE/EA–92012182) **Implementation plan for the environmental impact statement on the Strategic Petroleum Reserve expansion.** USDOE, Washington, DC (United States). Mar 1992. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012182. Source: OSTI; NTIS; INIS; GPO Dep.

During 1990, Congress enacted two bills requiring the Department of Energy (DOE) to undertake planning activities associated with the expansion of the Strategic Petroleum Reserve (SPR) from 750 million barrels to one billion barrels: the Energy Policy and Conservation Act Amendments of 1990 (P.L. 101-383) and the Department of Interior and Related Agencies' Appropriations Act for Fiscal Year 1991 (P.L. 101-512). DOE has determined that the development and operation of additional SPR crude oil storage facilities would be a major federal action significantly affecting the quality of the human environment, and, therefore, an environmental impact statement (EIS) will be prepared by DOE to assess the environmental impacts of the proposed action and alternatives. The EIS will be prepared in accordance with Section 102(2)(c) of the National Environmental Policy Act (NEPA), as stipulated in regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508, November 1978) and DOE's implementing guidelines (45 FR 20694, March 28, 1980). This report is a discussion of the implementation of the EIS.

18610 (DOE/EH–0189P) **Federal Environmental Permitting Handbook: Environmental Guidance.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. May 1991. 469p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The handbook consists of eight chapters addressing permitting and licensing requirements under the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA/SARA), the Atomic Energy Act (AEA), the Clean Air Act (CAA), the Clean Water Act (CWA), the Federal Insectide, Fungicide, and Rodenticide Act (FIFRA), the Safe Drinking Water Act (SDWA), and the Toxic Substances Control Act (TSCA). Each chapter consists of: (1) an introduction to the statute and permitting requirements; (2) a diagram illustrating the relationship between permitting requirements under the statute being discussed and permitting requirements from other environmental statutes which may have to be addressed when applying for a particular permit (e.g., when applying for a RCRA permit, permits and permit applications under the CWA, CAA, SDWA, etc. would have to be listed in the RCRA permit application); and, (3) a compilation of the permitting requirements for the regulatory program resulting from the statute. In addition, the Handbook contains a permitting keyword index and a listing of hotline telephone numbers for each of the statutes.

18611 (DOE/EH–231-002/0191-CERCLA) **Complying with land disposal restrictions (LDR) for CERCLA remedial actions involving contaminated soil and debris: CERCLA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and

Health, Washington, DC (United States). Office of Environmental Guidance. Jan 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. REMEDIAL ACTION/specifications; SOILS/remedial action; SOILS/contamination; WASTES/ground disposal; WASTE DISPOSAL/specifications; COMPLIANCE; US SUPERFUND; INFORMATION; SPECIFICATIONS; SOILS; CONTAMINATION; UNDERGROUND DISPOSAL; WASTES

18612 (DOE/EH-231-002/0191-RCRA) **The small-scale treatability study sample exemption: RCRA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Jan 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. HAZARDOUS MATERIALS/regulations; HAZARDOUS MATERIALS/testing; REGULATIONS; TESTING; INFORMATION; WASTES; SPECIFICATIONS; US EPA; REPORTING REQUIREMENTS

18613 (DOE/EH-231-007/1291) **Overview of the identification of hazardous waste under RCRA: RCRA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

This is an information brief regarding the definition/identification of hazardous materials regulated under the Resource Conservation and Recovery Act. (CBS)

18614 (DOE/EH-231-008/0991) **Natural resource damage assessment: Preassessment screening and integration with CERCLA ecological evaluations: CERCLA Information Brief.** Bascietto, J. USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Oct 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. US SUPERFUND/information; ENVIRONMENT/damage; POLLUTION REGULATIONS/enforcement; INFORMATION; LIABILITIES; EVALUATION; ENVIRONMENT; DAMAGE; US DOE; INVESTIGATIONS; ENFORCEMENT

18615 (DOE/EH-231-008/1291) **Identification of certain RCRA wastes: The F-spent solvent, P, and U listings: RCRA Information Brief.** Schumann, J. USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Dec 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. SOLVENTS/classification; HAZARDOUS MATERIALS/classification; INFORMATION; SOLVENTS; CLASSIFICATION; RECOMMENDATIONS; WASTE MANAGEMENT; WASTE WATER; REGULATIONS

18616 (DOE/EH-231-009/1291) **The information repository: RCRA/CERCLA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Nov 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. INFORMATION CENTERS/regulations; PUBLIC INFORMATION; US SUPERFUND; US EPA; DOCUMENTATION; REGULATIONS; US DOE

18617 (DOE/EH-231-009/1291-RCRA) **RCRA closure and post-closure plans: RCRA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. RADIOACTIVE WASTE FACILITIES/decommissioning; DECOMMISSIONING; REGULATIONS; US DOE; PLANNING; INFORMATION

18618 (DOE/EH-231-010/1291) **The administrative record: RCRA/CERCLA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Nov 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. RECORDS MANAGEMENT/regulations; US SUPERFUND; INFORMATION; ADMINISTRATIVE PROCEDURES; REGULATIONS; DOCUMENTATION; DOCUMENT TYPES; US DOE

18619 (DOE/EH-231-010/1291-RCRA) **RCRA clean closure equivalency demonstrations.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. RADIOACTIVE WASTE FACILITIES/decommissioning; HAZARDOUS MATERIALS; DECOMMISSIONING; RADIOACTIVE WASTE DISPOSAL; US EPA; REGULATIONS; COMPLIANCE; ADMINISTRATIVE PROCEDURES; INFORMATION

18620 (DOE/EH-231-011/0192) **Federal Agency Hazardous Waste Compliance Docket ("docket"): CERCLA Information Brief.** Schmidt, K. USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Jan 1992. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. CONTAMINATION/reporting requirements; US DOE/reporting requirements; CONTRACTORS/reporting requirements; US SUPERFUND; INFORMATION; US EPA; HAZARDOUS MATERIALS; CONTAMINATION; WASTE MANAGEMENT; CONTRACTORS

18621 (DOE/IE/10859-T3) **New Zealand: Asia-Pacific energy series, country report.** Yamaguchi, N.D.; Keevill, H.D. East-West Center, Honolulu, HI (United States). Mar 1992. 197p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-90IE10859. Order Number DE92011901. Source: OSTI; NTIS; INIS; GPO Dep.

The New Zealand energy sector has undergone significant changes in the past few years. Reform and deregulation came to New Zealand in large doses and at a rapid pace. Unlike Japan where deregulation was designed for a five-year phase-in period or even Australia where the government was fully geared up to handle deregulation, deregulation occurred in New Zealand almost with no phase-in period and very little planning. Under fast-paced "Rogernomics," the energy sector was but one more element of the economy to be deregulated and/or privatized. While the New Zealand energy sector deregulation is generally believed to have been successful, there are still outstanding questions as to whether the original intent has been fully achieved. The fact that a competent energy bureaucracy was mostly lost in the process makes it even more difficult to find those with long enough institutional memories to untangle the agreements and understandings between the government and the private sector over the previous decade. As part of our continuing assessment of Asia-Pacific energy markets, the Resources Programs at the East-West Center has embarked on a series of country studies that discuss in detail the structure of the energy sector in each major country in the region. To date, our reports to the US Department of Energy, Assistant Secretary for International Affairs and Energy Emergencies, have covered Australia, China, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, South Korea, Taiwan, and Thailand. The country studies also provide the reader with an overview of the economic and political situation in the various counties. We have particularly highlighted petroleum and gas issues in the country studies and have attempted to show the foreign trade implications of oil and gas trade. Finally, to the greatest extent possible, we have provided the latest available statistics.

18622 (IEE-SR-225) **Global-warming problem and global economic models.: Comparative analysis of simulation of CO_2 emission control.** Institute of Energy Economics, Tokyo (Japan). 30 Sep 1991. 200p. (In Japanese). Order Number DE92514557. Source: OSTI; NTIS (US Sales Only).

This report describes results of investigation, comparison and analysis of various global models to analyze what policies are effective for reduction of greenhouse effect gases as measures for prevention of the global warming and building of a well-balanced energy supply structure. The paper deals with global models like a general equilibrium macroeconomic model on a cost for reduction of CO_2 emission and an energy economy simulation model. The results of the simulation of global models indicate that there are big differences in optimum carbon tax rate between the models, but a drop in GDP growth rate affected by emission control is very low in each model. These results seem to be attractive. However, in the method using these models in which improvement of energy efficiency is regarded as a main factor, there is still some doubt whether CO_2 emission can be practically controlled in the long term. 58 refs., 47 figs., 8 tabs.

18623 (INFO–0206) **The distribution of fatal risk in Ontario industries.** Davis, C.K. (Waterloo Univ., ON (Canada)); Forbes, W.F.; Hayward, L.M. Atomic Energy Control Board, Ottawa, ON (Canada). Sep 1986. 121p. Order Number DE92627088. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study was to estimate non-radiological risks of occupational fatalities in Ontario industries. The distribution of high-risk occupations was found to vary widely between the different industries for a number of reasons including the fact that insufficient data in some instances resulted in less than desirable reliability. However, in spite of various data limitations, a number of occupations had above average fatal risk rates in several industries, including Material Handlers and Related, N.E.C. (SOC-9319), Welders and Flame Cutters (SOC-8335), Truck Drivers (SOC-9175) and Mechanics and Repairmen, except Electrical (SOC-8589). The majority of occupations had rates below or close to the industry average; however, between 15% and 30% of the occupations in any given industry had fatal risk rates above the industry average. When the number of workers involved in different occupations was considered, between 18% and 40% of workers were in occupations with above average risk. Recommendations for future work are also provided.

18624 (Juel–2553) **Environmental impact assessment in the field of research.** Angewandte Systemanalyse. Hirtz, W.; Huber, W. Forschungszentrum Juelich GmbH (Germany). Programmgruppe Systemforschung und Technologische Entwicklung. Nov 1991. 106p. (In German). (CONF-9106355–: Colloquium on environmental impact assessment in the field of research, Bonn (Germany), 5 Jun 1991). Order Number DE92511586. Source: OSTI; NTIS (US Sales Only).

The BMFT (Federal Ministry for Research and Technology) project "environmental impact assessment in the field of research" aims at developing an assessing method which makes sure that the effects on man and environment of technical developments as a result of research projects are recognized at an early stage. Those making the decisions are thus to be put as soon as possible into the position to decide prior or after a research project has been awarded which of the various environmental aspects are to be considered as relevant for the projects and are thus to be, formulated as targets or criteria, part of the project. Within the framework of this project, the colloquium documentated here was held. The colloquinum was divided into a methodical part with various proposals for impact assessment, and a practice-oriented part where possibilities and requirements, but also shortcomings, of such methods were discussed from the point of view of industry. (orig./HSCH).

18625 (NEI-NO–204) **Greenhouse effect, impacts and measures.** Miljoeverndepartementet, Oslo (Norway). Mar 1991 213p. (In Norwegian). Order Number DE92506540. Source: OSTI; NTIS (US Sales Only).

The report deals with an evaluation of the greenhouse effect with the focus on the impacts and measures. Following aspects are considered: Norwegian environmental policy - evaluations and conclusions; the greenhouse effect and the climate development; possible consequences of the greenhouse effect; international conditions and the work with a global climate agreement; means for reducing the emissions of climatic gases; economic impacts of limiting the CO_2-emissions; precautions within different sectors; further research and elucidation. 43 refs., 31 figs., 44 tabs.

18626 (NEI-NO–213) **A cleaner environment - a new Norwegian article for export?.** Senter for Oekonomisk Analyse (ECON), Oslo (Norway). 1991 70p. (In Norwegian). Order Number DE92506550. Source: OSTI; NTIS (US Sales Only).

The relation between combustion of fossil fuels and the greenhouse effect, and other environmental challenges have created new interest in Norwegian hydroelectric power as an energy source. By means of various scenarios an attempt has been made to elucidate the possibilities of Norwegian exports of hydro energy towards the year 2010. In two of the scenarios studied, the export amounts to between 13 and 15 TWh/y in 2010. 14 refs., 34 figs., 9 tabs.

18627 (NEI-NO–214) **Environmental policies and regulations on the electricity market in EC.** Boucher, J. Senter for Oekonomisk Analyse (ECON), Oslo (Norway). 1990 30p. Order Number DE92506551. Source: OSTI; NTIS (US Sales Only); INIS.

The use of natural resources like ground and water, the emissions of noxious gases and particles, the thermal rejections, the production of waste and the noise are the main environmental impacts associated with the production of electricity. Emission regulations and standards have been selected so far by the European Community (EC) and the different Member States to deal with the abatement problem. They simply consist in defining some ceilings or regulations for the different types of noxious gases and particles which are emitted by power plants and forcing the power generation companies to comply with these norms within some pre-determined time period. They can also take the form of a general constraint on the sulfur content of the fuel, for example. Tables of emission limits for various gases from existing and new plants are presented. 3 figs., 8 tabs.

18628 (PNL-SA–20400) **Energy conservation: The main factor for reducing greenhouse gas emissions in the former Soviet Union.** Bashmakov, I.A.; Chupyatov, V.P. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 29p. Sponsored by Environmental Protection Agency, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012355. Source: OSTI; NTIS; GPO Dep.

The energy intensity of the former Soviet Union is more than twice that of other market economics in similar stages of economic development. Low energy efficiency in the Soviet Union has contributed significantly to global carbon and other greenhouse gas emissions. The technological potential for energy conservation in the former Soviet Union is the largest in the world. The inefficiencies of the previously command-system economy, however, have provided little incentive for conserving energy. The present transition to a market-based economy should encourage the incorporation of energy-efficiency improvements in order for the former Soviet Union to successfully lower its energy intensity. There are several obstacles that limit implementing energy conservation: for example, energy prices and discount rates influence the volume of investment in energy efficiency. Nevertheless, cost-effective measures for energy conservative do exist even in the most energy-intensive sectors of the Soviet economy and should form the core of any energy conservation program. The overall cost-effective potential for carbon savings in the former Soviet Union is estimated to be 280 to 367 million tons of carbon per year by the year 2005, or 23 to 29 percent of 1988 energy-related emissions.

18629 (SAND–92-0247C) **The role that enviroTRADE will play in the cleanup of the DOE complex.** Harlan, C.P.; Harrington, M.W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920466–8: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92011654. Source: OSTI; NTIS; INIS; GPO Dep.

In support of the US Department of Energy's commitment to the remediation of waste sites throughout its complex, the DOE has recognized that it can accelerate its technology development efforts and leverage the expenditure of available funds through an international cooperation among government entities, private industry, and educational institutions. To support the technology transfer of environmental information, the DOE has sponsored the development of EnviroTRADE – an international information system that will facilitate the exchange of environmental restoration and waste management technologies worldwide. The system will contain profiles on both environmental restoration/waste management needs and foreign/domestic technologies. Users will be able to identify matches between worldwide needs and available or emerging technologies. Where matches between needs and existing technologies are not found, the system will identify the potential for development of new and innovative technologies to address environmental problems. EnviroTRADE will also provide general information on international environmental restoration and waste management organizations, sites, activities, and contacts.

18630 (UCRL-LR-109625) **Earthquake Alert System feasibility study.** Harben, P.E. Lawrence Livermore National Lab., CA (United States). Dec 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011816. Source: OSTI; NTIS; GPO Dep.

An Earthquake Alert System (EAS) could give several seconds to several tens of seconds warning before the strong motion from a large earthquake arrives. Such a system would include a large network of sensors distributed within an earthquake-prone region. The sensors closest to the epicenter of a particular earthquake would transmit data at the speed of light to a central processing center, which would broadcast an area-wide alarm in advance of the spreading elastic wave energy from the earthquake. This is possible because seismic energy travels slowly (3–6 km/s) compared to the speed of light. Utilities, public and private institutions, businesses, and the general public would benefit from an EAS. Although many earthquake protection systems exist that automatically shut down power, gas mains, etc. when ground motion at a facility reaches damaging levels, not EAS – that is, a system that can provide warning in advance of elastic wave energy arriving at a facility – has ever been developed in the United States. A recent study by the National Academy of Sciences (NRC, 1991) concludes that an EAS is technically feasible and strongly recommends installing a prototype system that makes use of existing microseismic stations as much as possible. The EAS concept discussed here consists of a distributed network of remote seismic stations that measure weak and strong earth motion and transmit the data in real time to central facility. This facility processes the data and issues warning broadcasts in the form of information packets containing estimates of earthquake location, zero time (the time the earthquake began), magnitude, and reliability of the predictions. User of the warning broadcasts have a dedicated receiver that monitors the warning broadcast frequency. The user also has preprogrammed responses that are automatically executed when the warning information packets contain location and magnitude estimates above a facility's tolerance.

2904 Energy Resources

Refer also to citation(s) 18137, 18141, 18167, 18646, 18665

18631 (CONF-9103215– xiv-xvii) **Biomass is the key to US energy needs and global environmental solutions.** Jura, J. (Bonneville Power Administration, Washington, DC (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The role of the Bonneville Power Administration (BPA) in the development of future bioenergy projects is examined. First, BPA is working to meet future energy needs through cooperation with other utilities, other regions and other nations. The second area pursued is promotion of conservation practices. The third area is development of new energy resources. Bioenergy is part of this effort. Highlighted are cogeneration projects, a 1.6 megawatt landfill gas project, use of wood pellets in place of oil-fired boilers, refuse-derived fuels, wood-fueled power plants, and co-fired generation plants.

18632 (DOE/BP–1729) **Draft 1992 Resource Program summary report.** USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1992. 47p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011278. Source: OSTI; NTIS; GPO Dep.

The Resource Program is the Bonneville Power Administration's primary process for deciding how to meet future resource needs – how much new resource development is needed by BPA, which types of resources to acquire and option, how to go about acquiring them, and how much to spend. The Northwest Power Planning Council completed a new Northwest Power Plan in 1991. This Draft Resource Program describes how BPA proposes to do its part to meet the Council's regional resource objectives.

18633 (DOE/CH/10093–86) **Conservation and renewable energy technologies for utilities.** National Renewable Energy Lab., Golden, CO (United States). Apr 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE91002106. Source: OSTI; NTIS; INIS; GPO Dep.

This publication presents current efforts by the US DOE Office of Utility Technologies to promote and develop cost-effective renewable energy and energy efficient technologies in the Utility sector. Major projects in the areas of solar thermal energy, solar photovoltaic energy, wind energy, geothermal energy, hydroelectric power, ocean power, and biomass are presented. The importance of efficient energy management in the transmission and distribution of electricity and through energy storage is discussed. (GHH)

18634 (DOE/CH/10093–90) **Tomorrow's energy today: Energy efficiency and renewable energy.** Brennan, A. National Renewable Energy Lab., Golden, CO (United States). Apr 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE91002110. Source: OSTI; NTIS; GPO Dep.

This broad overview of energy programs of the Office of Conservation and Renewable Energy of the US DOE emphasizes means of promoting energy efficiency for the next generation. Current research goals to reduce energy consumption in industry, buildings, and the transportation sector are presented. A doubling of economic growth without depleting fossil fuels by the year 2030 is conceivable. (GHH)

18635 (NEI-DK–822) **The agricultural sector as energy supplier: 1. Resources and the environment. 2. Intitiatives. 3. Energy duties. 4. Energy policy.** Jordbrugets Energiudvalg, Copenhagen (Denmark). May 1991 21p. (In Danish). Order Number DE92506380. Source: OSTI; NTIS (US Sales Only).

It is claimed that the arguments for the use of biomass fuels in Denmark are that they can be produced domestically so that Denmark can to this extent be independent of other countries, it encourages local employment and improves local economy, it does not contribute to the greenhouse effect, it is a renewable energy source which does not have to be mined, does not produce wastes and - there is enough of it. Agriculture can supply surplus straw, wood chips and methane from animal manures, vegetable oils, corn and root crops for the production of ethanol and crops that can be used directly as fuels in relation to district heating plants. The question of potentials in relation to energy supplies is discussed in relation to governmental energy and environmental policy and various district heating plants which use straw and wood chips are described. Ethanol production in Denmark, potentials for the cultivation of crops, such as elephant grass, that can be used directly as fuels and rape oil production are discussed in addition to Danish energy taxes and energy policy. (AB).

18636 (SAND–92-0523C) **The status of renewable energy technology.** Schueler, D.G. Sandia National Labs., Albuquerque, NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9206114–5: Annual meeting of the Air and Waste Management Association (AWMA), Kansas City, MO (United States), 21-26 Jun 1992). Order Number DE92011386. Source: OSTI; NTIS; INIS; GPO Dep.

Renewable energy technologies convert naturally occurring phenomena into useful energy forms. These technologies use resources that generally are not depleted, such as the direct energy (heat and light) from the sun and the indirect results of its impact on the earth (wind, falling water, heating effects, plant growth), gravitational forces (the tides), and the heat of the Earth's core (geothermal), as the sources from which they produce useful energy. These very large stores of natural energy represent a resource potential that is incredibly massive – dwarfing that of equivalent fossil energy resources. The magnitude of these resources is, therefore, not a key constraint on energy production. However, they are generally diffuse and not fully accessible, some are intermittent, and all have distinct regional and local variability. It is these aspects of their character that give rise to difficult, but generally solvable, technical, institutional, and economic challenges inherent in development and use of renewable energy resources. This report discusses the technologies and their associated energy source.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 18133, 18434, 18624, 18629, 18633, 18684, 19351, 19352, 19945

18637 (DOE/ER/75564–9) **A program for the transfer of manufacturing technology from the national laboratories: Annual performance report, March 12, 1990–March 11, 1991.** Shackson, R.H. Industrial Technology Inst., Ann Arbor, MI (United States). Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER75564. Order Number DE92011905. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to test a needs-driven approach to transfer of manufacturing technology from the National Laboratories. The first task was the development of a 250-page book, describing the durable goods industry and its technological needs. This book was used in three engagements with DOE labs, in which researchers were briefed on needs, and asked to nominate technologies to meet these needs. Of 47 nominations, approximately one-third were technologies that has not been recognized as having value, and were not listed on the Laboratory's data base. After several evaluation steps, commercialization planning is underway for six, and one is being considered for prototype development.

18638 (LA-UR–92-890) **Los Alamos National Laboratory and technology transfer.** Bearce, T.D. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920376–1: Meeting of the American Physical Society, Indianapolis, IN (United States), 16-20 Mar 1992). Order Number DE92011360. Source: OSTI; NTIS; GPO Dep.

From its beginning in 1943, Los Alamos National Laboratory (Los Alamos) has traditionally used science and technology to fine creative, but practical solutions to complex problems. Los Alamos National Laboratory is operated by the University of California, under contact to the Department of Energy. We are a Government Owned-contractor Operated (GOCO) facility, and a Federally-funded research and Development Center (FFRDC). At Los Alamos, our mission is to apply science and engineering capabilities to problems of national security. Recently our mission has been broadened to include technology transfer to ensure the scientific and technical solutions are available to the marketplace. We are, in staff and technical capabilities, one of the worlds largest multidisciplinary, multiprogram laboratories. We conduct extensive research in energy, nuclear safeguards and security, biomedical science, conventional defense technologies, space science, computational science, environmental protection and cleanup, materials science, and other basic sciences. Since 1980, by a series of laws and executive orders, the resources of the federal laboratories have been made increasingly available to private industry via technology transfer efforts. Los Alamos National Laboratory uses a variety of technology transfer methods including laboratory visits, cooperative research, licensing, contract research, user facility access, personnel exchanges, consulting, publications, and workshops, seminars and briefings. We also use unique approaches, such as our negotiating teams, to ensure that transfer of our developed technology takes place in an open and competitive manner. During my presentation, I will discuss the overall process and some of the mechanism that we use at Los Alamos to transfer laboratory developed technology.

2906 Nuclear Energy

Refer also to citation(s) 18350, 18351, 18658, 18659, 18665

18639 (AECB-C–110) **Implementation of a program to recover the Atomic Energy Control Board's operating costs: Proposed policy for cost recovery.** Atomic Energy Control Board, Ottawa, ON (Canada). 3 Mar 1989. 14p. (In English, French). Order Number DE92627087. Source: OSTI; NTIS (US Sales Only); INIS.

Issued for comment.

The Canadian Atomic Energy Control Board (AECB) has undertaken a preliminary study to examine the feasibility of recovering the costs of its regulatory activities in accordance with the Canadian federal government user-pay principle. This study has found that recovery of the AECB's entire budget of $25 million per year would not have a significant financial impact on its licensees. The AECB has prepared regulations and a fee schedule and carried out consultations with the nuclear industry and the public to determine the potential financial and economic impacts of this initiative.

18640 (INFO–0207) **Some thoughts about risk.** Jennekens, J.H. Atomic Energy Control Board, Ottawa, ON (Canada). May 1986. 10p. (CONF-8605373–: Symposium on the total risk and benefit impact of energy alternatives, Waterloo (Canada), 20-23 May 1986). Order Number DE92627089. Source: OSTI; NTIS (US Sales Only); INIS.

The author discusses how the concept of risk is perceived differently by the scientist and the man in the street, and mentions the problems that this can sometimes pose for the regulator. He also gives examples of inconsistencies and contradictions in various areas of risk management. He concludes by noting that so-called accidents usually do not occur by chance, but that system or component failures are always due to some form of human error. The objective of risk management is to ensure, by a process of rigorous analysis, that both the probability and consequences of such failures are minimized.

18641 (INFO–0212) **Nuclear safety. Living up to high expectations today, tomorrow.** Jennekens, J.H. Atomic Energy Control Board, Ottawa, ON (Canada). Oct 1986. 14p. (In English, French). Order Number DE92628370. Source: OSTI; NTIS (US Sales Only); INIS.

How safe is safe enough? In the nuclear energy field, whenever government, the nuclear industry, or independent researchers have presented the public with an answer to this question it has been met with a demand for more safety-related controls on the industry. It is doubtful whether doubling the $25 million budget of the Canadian Atomic Energy Control Board (AECB) would result in twice as much nuclear safety. It is disturbing that people feel there is not enough information; the much of the information the AECB makes available has been ignored. In the long term it is important that the public become confident in nuclear safety. It may be that some day all toxic waste will have to be managed as safely as nuclear waste.

18642 (INFO–0359) **Improving the safety culture of human organizations: A proposal for institutional quality assurance.** Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Nuclear Safety. Feb 1990. 54p. (In English, French). (ACNS–17;CCSN–17.). Order Number DE92627090. Source: OSTI; NTIS (US Sales Only); INIS.

Inquiries into past serious accidents, both nuclear and non-nuclear, reveal that the causes, largely attributed to human error, are also failures on the part of the institutions responsible. Conventional wisdom holds that quality assurance is an essential element for any production process, but the inquiries have not suggested applying quality assurance to the institutions themselves. The ACNS argues the need for Institutional Quality Assurance, with some illustrations of what might be involved, and proposes what should be done to achieve this end.

18643 (INIS-mf–13187) **Environmental scan: Opportunities and challenges.** Atomic Energy of Canada Ltd., Ottawa, ON

(Canada). 1988 34p. Order Number DE92627092. Source: OSTI; NTIS (US Sales Only); INIS.

Trends in current affairs and public policy that emerged in 1988 are analyzed to provide a tool for Atomic Energy of Canada's decision makers. This issue provides a general overview of the economic and energy environments; and international review of nuclear policies, equipment orders, and trends that will position Canada and AECL within the global nuclear community; a precis of Canadian public opinion polls on economic, environmental and energy issues; a summary of major trends identifies by Canadian opinion leaders from the public and private sectors; a review of opinions and recommendations of influential Canadian policy institutes; a report on government policies and actions that affect AECL directly or indirectly; an analysis of new coverage by print and electronic media; a review of anti-nuclear organizations; and conclusions and recommendations.

18644 (NUREG-0544-Rev.3) **NRC collection of abbreviations: Revision 3.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Mar 1992. 227p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The US Nuclear Regulatory Commission (NRC) staff collected this list of abbreviations from NRC documents and nuclear industry documents, both foreign and domestic. Readers can use the collection, which is not all inclusive, to identify the terms from which the abbreviations are formed. The Editorial Section of the Division of Freedom of Information and Publications Services compiled this collection. In the introduction, the editorial staff offers suggestions for using abbreviations but does not recommend the use of one abbreviation over another.

2907 Transport and Storage

Refer also to citation(s) 18633

2908 Heat Utilization

18645 (CONF-9001171-, pp. 49-63) **Waste heat utilization - heat storage.** Hahne, E. (Stuttgart Univ. (Germany). Inst. fuer Thermodynamik und Waermetechnik). Daimler-Benz AG, Berlin (Germany). Forschung Technikumfeld. Feb 1991. 125p. (In German). From Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990. In *Potential and assessment of alternative energy conversion processes. Sub-project B: Energy conversion processes - potential and assessment. Proceedings.* Order Number DE92515841. Source: OSTI; NTIS (US Sales Only).

On a comparative basis, the differences of the two types of power stations, condensation power station and heating power station are emphasized especially with regard to the energy utilization degree. Following this, the possibilities of storing sensible, latent heat and heat from chemical reaction are described, where the utilization range especially for heating and hot water heating in buildings is increased by the application of the heat pump. (UA).

2910 Conservation

Refer also to citation(s) 18634, 18699, 18709, 18719

18646 (CONF-9103215- ix-x) **Welcoming remarks.** Higginson, R.K. (Idaho Dept. of Water Resources, Boise (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Idaho's Department of Water Resources is responsible for a number of programs in energy conservation: renewable energy resources, oil overcharge rebate programs and similar related energy functions. In his welcoming remarks, the Director describes the Department's involvement in bioenergy programs. Among them are: feasibility studies of wood-fired cogeneration systems; municipal solid wastes for cogeneration; assessment of biomass resources for energy recovery using forest residues, mill residues, crop residues, municipal solid waste and animal wastes. Inventories of biomass and biomass uses have been conducted and a permit handbook for bioenergy projects has been issued. The growing involvement of the Department of Water Resources in bioenergy programs is the result of energy shortages, the need to reduce reliance on imported oil and of increasing waste disposal problems.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 17827, 18600

18647 (NEI-NO-210) **A critical analysis of prognoses for petroleum demand in developing countries.** Andersen, G.H. Fridtjof Nansens Inst., Lysaker (Norway). 1990 61p. (In Norwegian). Order Number DE92506547. Source: OSTI; NTIS (US Sales Only).

This study shows that there are great uncertainties attached to the prognoses for petroleum demand in developing countries. The prognoses tell what probably will happen, given a specified development in the exogenous variables, and given fairly constant frames of reference (absence of major international conflicts, and similar conditions). It is, however, important to give the prognosis users information about the assumptions that have been made, to enable them to consider whether these assumptions are valid. One should also inform the users of the limitations in the data and possible consequences of these limitations. 24 refs., 10 figs., 11 tabs.

18648 (PNL-8058) **Energy use baselining study for the National Naval Medical Center.** Parker, G.B.; Halverson, M.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 281p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011673. Source: OSTI; NTIS; GPO Dep.

This report provides an energy consumption profile for fourteen buildings at the National Naval Medical Center (NNMC) in Bethesda, Maryland. Recommendations are also made for viable energy efficiency projects funded with assistance from the servicing utility (Potomic Electric Power Company) in the form of rebates and incentives available in their Demand Side Management (DSM) program and through Shared Energy Savings (SES) projects. This report also provides estimates of costs and potential energy savings of the recommended projects.

18649 (SEI-EED-11) **Energy assistance revisited - A discussion paper.** Foley, G. Stockholm Environment Inst. (Sweden). 1991. 32p. Order Number DE92506569. Source: OSTI; NTIS (US Sales Only).

Energy assistance over the past two decades has had a dissapointing record. Many projects, especially in the fuelwood and household energy sectors, have failed completely; and the majority of programmes to promote renewable energy sources, apart from large scale hydro, have had little impact. In the power sector, despite massive amounts of assistance, the financial and technical condition of a large number of electricity utilities is now worse than it was a decade ago. This paper examines the assumptions and attitudes which under-pinned the energy assistance policies widely followed by the international donor community during the 1970s and 1980s and tries to explain why they had so little success. It then attempts to look forward and identify the new questions, preoccupations, and opportunities for action which will determine the policies of the 1990s. 40 refs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 18119, 18120, 18123, 18600, 18609, 18657, 19107, 19433, 20626

18650 (NEI-DK-819) **Summarizing viewpoints relating to the plan of management included in Energy 2000.** Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark). Planlaegningsafdelingen. Feb 1991 44p. (In Danish). Order Number DE92506385. Source: OSTI; NTIS (US Sales Only).

Comments are offered by the Danish electric power company ELSAM on the Danish government publication regarding energy and environmental policy in Denmark, "Energy 2000. Plan of management for a sustainable development". Points for discussion are the continuation of the current developments without consideration of CO_2 emission, political initiatives which are aimed at a 20% reduction of CO_2 emission by the year 2005 without influencing the public needs for energy services, and a concrete plan which shows the effect of the management programme, bearing in mind the governmental ambitions regarding reduction of carbon dioxide. (AB).

18651 (NEI-DK--820) **Summarizing viewpoints relating to the plan of management included in Energy 2000: Supplement 1. Operational consequences of the plan of management.** Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark). Planlaegningsafdelingen. Feb 1991 27p. (In Danish). Order Number DE92506387. Source: OSTI; NTIS (US Sales Only).

The Danish electricity company, ELSAM, tests the basis for decisions taken in the publication relating to national energy and environmental policy, "Energy 2000", by carrying out calculations regarding the electric power production system in this plan. For this purpose a very detailed simulation model is used. At the same time the Danish Energy Agency has made similiar calculations based on their own system. The results in both cases are presented and commented upon. (AB).

18652 (NEI-DK--821) **Summarizing viewpoints relating to the plan for management included in Energy 2000: Supplement 2. Evaluation of the economical aspects of the plan of management (Electric power and cogeneration of heat and electricity).** Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark). Planlaegningsafdelingen. Feb 1991 23p. (In Danish). Order Number DE92506388. Source: OSTI; NTIS (US Sales Only).

It is claimed that one of the main arguments for the promotion of the the Danish plan of management for energy and environmental policy was that it should make possible the reduction of CO_2 by 20% (by the year 2005) without extra cost. The electric power company ELSAM suggests that such a prognosis, based on the assumption of a sharp decrease in national energy consumption, is very difficult to predict, and that technological developments aimed at reducing CO_2 emission can be expensive. These points are discussed in detail. The text is illustrated by tables of data and graphs. (AB).

18653 (NEI-DK--824) **Adjustment of energy production and consumption in Poland: Projektbeskrivelse.** Llado, A.G. Roskilde Universitetscenter (Denmark). Inst. for Miljoe, Teknologi og Samfund. Oct 1990 34p. (In Danish). Order Number DE92506460. Source: OSTI; NTIS (US Sales Only).

Energy problems in Poland are discussed in relation to production and consumption, environmental problems and planning. The aim was to point out the possiblities of living up to the main principles named in the "Brundtland report", practical suggestions as to the means of restructuring energy production and consumption and the development of an analytic method for determining and evaluating the sustainability of various development tendencies. (AB).

2940 Fossil Fuels

Refer also to citation(s) 17708, 17770, 17779, 17800, 17821, 17822, 17841, 17853, 17854, 17855, 17856, 17858, 17859, 17860, 17879, 18192, 18621, 18647, 18658, 18659, 18665, 18715, 18809

18654 (DOE/EIA--0520(92/03)) **International petroleum statistics report, March 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 7 Apr 1992. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011453. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e. non-communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, consumption, and trade in OECD countries. World oil production and OECD consumption data are for the years 1970 through 1990; OECD stocks from 1973 through 1990; and OECD trade from 1982 through 1990.

18655 (DOE/EIA--0543(91/4Q)) **US energy industry financial developments, 1991 fourth quarter.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Apr 1992. 15p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011625. Source: OSTI; NTIS; GPO; GPO Dep.

The following points highlight fourth-quarter energy developments: Due to lower crude oil and natural gas prices, the domestic and foreign oil and gas production operations of major petroleum companies reported respective income declines of 67 and 46 percent between the forth quarter of 1990 and the fourth quarter of 1991. Over the same period, independent oil and gas producers saw their income drop 72 percent. Financial results for downstream petroleum activities were mixed. Although the major petroleum companies experienced reduced domestic refining/marketing income for the fourth quarter of 1991, independent refiners and the foreign refining/marketing operations of the majors experienced improved earnings. Due to the severely depressed state of domestic drilling activity, oil field companies reported an 18-percent decline in income for the fourth quarter of 1991. Rate-regulated utilities saw a 3-percent rise in earnings as colder weather relative to 1990's final quarter led to increased residential and commercial electricity usage.

18656 (DOE/FE--0252T) **Fossil energy: From laboratory to marketplace.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Apr 1991. 57p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013596. Source: OSTI; NTIS; GPO Dep.

Fossil Energy-From Laboratory to Marketplace is a compendium of progress--progress achieved by teams of university, industrial, and government researchers working through the federal program to develop new, cleaner and more effective ways to produce and use the nation's abundant fossil fuel resources. Generally, this report concentrates on research and development efforts conducted during the 1980s. Where necessary to provide an historical context, information is also drawn from the fossil energy research, development and demonstration programs of the 1970s.

18657 (NUTEK-B--91-8) **Energy and the European Community.** Andersson, Hans; Bjoerk, O.; Eurenius, P.; Goeransson, A.; Olofsdotter, A. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1992. 113p. (In Swedish). Order Number DE92506600. Source: OSTI; NTIS (US Sales Only).

This report describes the energy market regulations within the European Community, and the changes of the rules when proceeding towards the Inner Market. It is especially important for Sweden to increase the knowledge within the country concerning this development, due to the possibility of beeing a future member state, but also due to the important trade connections with the EC. Chapters elucidate the rules and regulations within the energy sector, environment protection demands, necessary adjustments to the EC for Sweden, and the structure of coal-, oil-, and natural gas markets.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 18809

2960 Electric Power

Refer also to citation(s) 17827, 18228, 18285, 18578, 18586, 18665, 18787

18658 (DOE/EIA–0226(91/12)) **Electric power monthly, December 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 16 Dec 1991. 199p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012427. Source: OSTI; NTIS; GPO; GPO Dep.

The Electric Power Monthly (EPM) is prepared by the Survey Management Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy. This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fuel are also displayed for the North American Electric Reliability Council (NERC) regions. Additionally, statistics by company and plant are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fuel.

18659 (DOE/EIA–0226(92/03)) **Electric power monthly, March 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 20 Mar 1992. 193p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012426. Source: OSTI; NTIS; GPO; GPO Dep.

The Electric Power Monthly is prepared by the Survey Management Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy. This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fuel are also displayed for the North American Electric Reliability Council (NERC) regions. Additionally, statistics by company and plant are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fuel.

18660 (NRRI–92-5) **Contract pricing of electric and telephone service: Current practice and policy.** Rosenberg, E.A.; Duann, D.J.; Nagler, P.A.; Wasden, C.D. National Regulatory Research Inst., Columbus, OH (United States). Apr 1992. 204p. Sponsored by National Association of Regulatory Utility Commissioners, Washington, DC (United States); National Regulatory Research Inst., Columbus, OH (United States). Source: OSTI; National Regulatory Research Institute, 1080 Carmack Rd., Columbus, OH 43210.

Due mainly to competitive pressures, the practice of offering electric and telephone service under contracts or special tariffs negotiated individually between a utility and its customers has increased in importance in recent years. Moreover, the practice is likely to become still more widespread in the future. This creates questions of public policy that are of interest to regulators and ratepayers alike such as how to supervise the practice, how to encourage utilities to compete while preventing cross-subsidization and anticompetitive behavior, and how the practice will ultimately affect utilities and ratepayers. This report sheds light on the topic by describing approaches that have been taken by the various regulatory commissions and by providing a framework for analyzing such contractors.

18661 (NUTEK-B–91-7) **Power markets in Europe.** Andersson, Hans; Bjoerk, O.; Enqvist, I.; Kornerud, S.; Ohlsson, Hans; Olofsdotter, A.; Petsala, B.; Wikstroem, A. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1991. 169p. (In Swedish). Order Number DE92506586. Source: OSTI; NTIS (US Sales Only).

This report is the first in an intended yearly description of the current development of the European electric power markets. It concerns production, transmission and utilization of electric power. Differences between the countries in pricing structure, production capacities and utilized technology is elucidated. The impact of the Common Market integration is discussed as well as the future role of energy conservation measures and the need for improved transmission capacities to facilitate bying and selling electric power according to regional demands.

18662 (SV-U–91-48) **From idea to investment: Energy end-use and possible electricity conservation among, mainly, light industry. Final report from Mission 2000 (UPPDRAG 2000) - Industry.** Eklund, S.A. Vattenfall Utveckling AB, Vaellingby (Sweden). Nov 1991. 82p. (In Swedish). Order Number DE92506570. Source: OSTI; NTIS (US Sales Only).

With 2p english summary.

UPPDRAG 2000 Industri has concentrated its work on the non-electricity-intensive part of the true industrial sector. This includes the food industry, textile industry, wood products industry, graphics industry, production industry and parts of the chemical and quarrying industry. Although, in numerical terms, this group includes most of the companies in the industry sector - 7000, or about 85% - it uses only about 25% of the total electricity use of the industrial sector, i.e. about 14 TWh$_e$ in 1989. The work of Uppdrag 2000 included investigation of the potentials for electricity conservation in the existing built environment and existing plants and installations using present-day technology. This potential has been estimated, based on surveys and on actual trials, and restricted to measures that are economically justifiable if compared with the costs of new electricity production.

18663 (SV-UE–91-63) **Future control systems.** Severin, E. Vattenfall Utveckling AB, Vaellingby (Sweden). 18 Dec 1991. 26p. (In Swedish). Order Number DE92506572. Source: OSTI; NTIS (US Sales Only).

The goal of this report has been to high-light the areas where Vattenfall's development, in the control systems field, ought to be concentrated in the next few years to come. To serve as a basis for this work an analysis has been made of the areas, within Vattenfall's fields of activity, where control systems will play an important role in the coming 20 years. By compiling the problem areas within the different fields of activity the report makes a synthesis of the functions which should be paid most of the interest and the technical problems where development work is most essential. The function which is most important for a future control system is it's ability to allow changes within the system to be made in the most cost efficient manner. The control systems must be designed to be flexible for future needs so it can easily be adapted to the constant development in technology and restructuring of functions. This new system philosophy has to effect the design solutions in the technical problem area which are most critical from development and cost point of view. Several of these technical areas are referred to in the report and the most important are: * Communication, * Optimization, * Management support systems, * Availability and safety. The scanning of international R and D activity in the control systems field referred to in the report gives a background against which the suggested priority for Vattenfall's development activities can be viewed. Finally the report tries to visualize the result of the suggested development activity so it fits in with an assumed development over a 10-20 years time scale.

18664 **Aesthetic-quality issues and their treatment in electric transmission-line planning - toward a new paradigm.** Priestley, T.J. California Univ., Berkeley, CA (United States). 1988 263p. Source: University Microfilms, PO Box 1764, Ann Arbor, MI 48106, Order No. 89-16,842.

In response to recent court decisions and regulatory changes that have greatly enhanced the importance of aesthetic issues in environmental decision making, visual analysis - the assessment of landscape aesthetic quality and the aesthetic implications of landscape change - has become an important part of landscape architecture and environmental planning practice. This paper's underlying concern is that ideas and methods now commonly used to evaluate landscape aesthetics and the aesthetic effects of transmission lines and other large infrastructure projects do not provide an entirely adequate basis for decision making. A number of the transmission-line visual assessment methods are reviewed in detail and are found wanting. The paper argues for developing a paradigm that will re-frame the aesthetic-quality issues in a way that takes psychological and social dimensions into account, permits the analyses to play an interactive role in the decision-making process, and allows the methods' assumptions and results to be empirically validated. As a first step, a case study was made of the portion of the recently completed Lakeville-Sobrante transmission line crossing a residential area in Vallejo, California.

2980 Consumption and Utilization

Refer also to citation(s) 18634

18665 (DOE/EIA-0035(92/03)) **Monthly Energy Review, 1991 Annual Summary.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 26 Mar 1992. 158p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011251. Source: OSTI; NTIS; GPO; GPO Dep.

The Monthly Energy Review is prepared by the Energy Information Administration. Statistical data and information has been compiled for the following topics: Energy Overview, Energy Consumption, Petroleum, Natural Gas, Oil and Gas Resource Development, Coal, Electricity, Nuclear Energy, Energy Prices, and International Energy.

18666 (DOE/EIA-0469(90)) **Energy facts, 1990.** USDOE Energy Information Administration, Washington, DC (United States). [1991]. 135p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012425. Source: OSTI; NTIS; GPO Dep.

Energy Facts, organized by energy source, is a compilation of energy data providing a reference to a broad range of domestic and international energy data, for the general public as well as the technical community. This report is designed especially for the business person, government worker, or student who needs a quick reference to major facts about energy. Each table of statistics appears on the opposite page from a corresponding graphic. The graphic has a point of interest rather than a title across the top.

18667 (DOE/EIA-0555(92)/1) **Energy consumption series: Lighting in commercial buildings.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 11 Mar 1992. 105p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012432. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

Lighting represents a substantial fraction of commercial electricity consumption. A wide range of initiatives in the Department of Energy's (DOE) National Energy Strategy have focused on commercial lighting as a potential source of energy conservation. This report provides a statistical profile of commercial lighting, to examine the potential for lighting energy conservation in commercial buildings. The principal conclusion from this analysis is that energy use for lighting could be reduced by as much as a factor of four using currently available technology. The analysis is based primarily on the Energy Information Administration's (EIA) 1986 Commercial Buildings Energy Consumption Survey (CBECS). The more recent 1989 survey had less detail on lighting, for budget reasons. While changes have occurred in the commercial building stock since 1986, the relationships identified by this analysis are expected to remain generally valid. In addition, the analytic approach developed here can be applied to the data that will be collected in the 1992 CBECS.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 18196, 18232, 18621

18668 (NEI-DK-814) **Plan of management for renewable energy 1992-94.** Energistyrelsen, Copenhagen (Denmark). Dec 1991 118p. (In Danish). Order Number DE92506352. Source: OSTI; NTIS (US Sales Only).

Danish energy policy, which pays serious attention to the protection of the environment, recommends the development of technology in relation to wind, solar and bio-energy, so that in the long run renewable energy can play a larger part in the Danish energy system. In June, 1991, the Danish Minister of Energy set up a Council for Renewable Energy with sub-committees for wind and solar energy and for energy derived from biomass. The Council produced a three-year plan of management for this sector as a basis for political decisions and following activities. The committee recommends that the use of renewable energy sources should be more than doubled by the year 2005. Long-term perspectives, economic aspects and also constraints are discussed in relation to wind, solar and bio-energy, and budgets are set up in each case. Other technologies, for example with regard to hydrogen as a fuel, system combinations, heat pumps and the use of renewable energy in the developing countries are also discussed. The committees conclusions and recommendations are given. (AB) 11 refs.

18669 (NEI-DK-830) **Other technologies and systems: Report.** Juhler Hansen, H.J. Energistyrelsen, Copenhagen (Denmark). Nov 1991 42p. (In Danish). Order Number DE92506468. Source: OSTI; NTIS (US Sales Only).

It is pointed out that in addition to wind and solar energy and energy derived from biomass there are also other renewable energy sources. The Danish Council for Renewable Energy, under the Ministry of Energy, recommends that in the future attention should be concentrated on hydrogen fuel technology and renewable energy, the solving of combined energy and environmental problems in relation to buildings, the use of renewable energy in developing countries, and the combination of energy systems. These points are discussed individually, especially with regard to possible constraints, demands and, in the case of hydrogen used as fuel, environmental impacts. The Council also recommends that the government should be open to the potentials of using other, untraditional, forms of energy (such as that obtained from sea waves and geothermal energy) which have not so far been mentioned in the plan of management as worthy of special investigation. (AB) 37 refs.

18670 (NEI-DK-832) **Status and perspectives for the development of wind power in Denmark: Proposal for a program of development for wind power in Denmark.** Energistyrelsen, Copenhagen (Denmark). Faglige Udvalg for Vindkraft. Dec 1991 58p. (In Danish). Order Number DE92506466. Source: OSTI; NTIS (US Sales Only).

The committee set up by the Danish Energy Agency recommends that the technical potentials for the utilization of wind power in Denmark should be promoted through continued research, development and demonstration of new and better wind power systems, through ensuring optimal use of the best siting possibilities, by attempts to remove restraints, by increasing international cooperation within this field and by supporting Danish wind industry and exports. The general development within the field of wind power should support the goals for pollution abatement described in the Danish publication "Energi 2000", which sets out principles for the country's energy and environmental policy. Developments already undergone are described, and tendencies of future development and the need for future research are discussed in addition to the expected barriers and ways of overcoming them. (AB) 18 refs.

18671 (NUTEK-B-91-1) **Bioenergy and the greenhouse effect: Proceedings of a seminar in Stockholm, 15-16 Apr 1991.** Mitchell, C.P. (ed.). NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 1991. 141p. (CONF-9104359-: Bioenergy and the greenhouse effect, Stockholm (Sweden), 15-16 Apr 1991). Order Number DE92506577. Source: OSTI; NTIS (US Sales Only).

The documentation from the seminar Bioenergy and the Greenhouse Effect gives an overview of the scientific knowledge of the global warming issue and how the production and use of bioenergy can decrease the carbon dioxide emissions. Different technologies are discussed for production of biomass fuels, for conversion of the fuel to heat and electricity via combustion and other thermal conversion techniques like gasification and pyrolysis. The potential role of alcoholic fuels in the transportation sector in reducing carbon dioxide emissions is discussed as it can make a significant impact since the transportation sector - in industrial nations - contributes up to 32% of carbon dioxide emissions. Techniques for using the decomposition process of organic waste materials in landfill into methane are considered and presented both as an energy and an environmental theme. Separate abstracts were prepared for all the 7 papers in this volume.

18672 (OEFZS–4598) **Heat pump technology in the present environment- and energy situation.** Faninger, G. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Oct 1991. 18p. (In German). Order Number DE92626261. Source: OSTI; NTIS (US Sales Only); INIS.

Ambient heat, used by heat pump technologies, is a domestic and renewable source of energy. The utilization of ambient heat corresponds to the goals of a future oriented energy policy: (1) the reduction of primary energy requirements and imports, especially oil, (2) the increased use of domestic renewable energies, (3) reduction of CO_2-emissions. The efficient use of heat pumps for space heating is determined by a number of criteria: low as possible supply temperatures of the heating system, appropriate designing and efficient control. In 1990, the number of heat pumps installed in Austria amounted to a total of about 96000 systems. The present contribution of heat pump technology to the energy supply amounts to about 950 GWh per year (December 1990). This amount corresponds to a saved quantity of oil of about 180000 tons per year. (author).

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 18345, 18565, 20442

18673 (DOE/ET/10815–173) **The Magnetohydrodynamics Coal-Fired Flow Facility: Technical progress report, April 1, 1991–June 30, 1991.** Tennessee Univ., Tullahoma, TN (United States). Space Inst. Feb 1992. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79ET10815. (UTSI–91-05). Order Number DE92011025. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to provide the status of a multi-task research and development program in coal fired MHD/steam combined cycle power production. More detailed information on specific topics is presented in topical reports. Current emphasis is on developing technology for the Steam Bottoming Cycle Program. The approach being taken is to design test components that simulate the most important process variables, such as gas temperature chemical composition, tube metal temperature, particulate loading, etc., to gain test data needed for scale-up to larger size components. Previous reports have provided comprehensive data on NO_x and SO_x control, radiant heat transfer, particulate control (baghouse and electrostatic precipitator), environmental monitoring, and analyses of test data on the convective heat transfer components (superheater and air heater). For this quarter, additional data on these subjects, plans for materials testing in future western coal tests and environmental and diagnostic results from the final planned test on eastern coal are reported. Detailed data analyses will be contained in test reports, topical reports or technical papers. By the use of these quarterly technical progress reports, MHD program participants and others interested in the technology will be able to gain the knowledge necessary for the confident design of a scaled-up steam bottoming plant.

18674 (DOE/ET/10815–T34) **The Magnetohydrodynamics Coal-Fired Flow Facility: Technical progress report, July 1, 1989–September 30, 1989.** Tennessee Univ., Tullahoma, TN (United States). Space Inst. Mar 1990. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79ET10815. (UTSI–89-05). Order Number DE92011024. Source: OSTI; NTIS; GPO Dep.

In this report the primary experimental results are derived from a 263 hour coal-fired proof-of-concept (POC) test conducted during the quarter. For the last 50 hours of the test the K_2/S ratio was increased to 1.3 to examine the fouling characteristics and the efficiency of the baghouse and electrostatic precipitator in removing this potassium carbonate rich solids. In this particular test, little difficulty was encountered in removing the deposits from the heat transfer tubes to permit continued operation of the flow train. However, difficulty is reported in removal of particulate with the electrostatic precipitator whose efficiency degraded seriously during the high carbonate period. Slag deposit thickness and chemical composition throughout the flow train is reported. The performance of downstream flow train components is discussed along with deposition and corrosion probe performance. A summary is included on the corrosion evaluation of the tubes which were removed after having completed 500 hours of coal fired testing. The performance of the baghouse and electrostatic precipitator throughout the test is discussed. Performance of advanced measurement systems provided by both UTSI and Mississippi State University is summarized. The modifications to the facility including the addition of a storage warehouse and work on providing an automatic ash/seed handling system and capability to process Western coal are reported. A brief study of the desirability of drying Western coal is included. Finally, the status of the environmental program and particulate measurements made during the test are reported. The State of Tennessee compliance testing results are reported.

18675 (DOE/PC/90274–T12) **MHD Technology Transfer, Integration and Review Committee: Fifth semi-annual status report, April 1990–September 1990.** TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div. Jan 1992. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–91-021). Order Number DE92012687. Source: OSTI; NTIS; GPO Dep.

This fifth semi-annual status report of the MHD Technology Transfer, Integration, and Review Committee (TTIRC) summarizes activities of the TTIRC during the period April 1990 through September 1990. It includes summaries and minutes of committee meetings, progress summaries of ongoing Proof-of-Concept (POC) contracts, discussions pertaining to technical integration issues in the POC program, and planned activities for the next six months.

18676 (DOE/PC/90274–T13) **MHD Technology Transfer, Integration and Review Committee: Sixth semi-annual status report, October 1990–March 1991.** TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div. Jan 1992. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–92-019). Order Number DE92012688. Source: OSTI; NTIS; GPO Dep.

As part of Task 8 of the MHD Integrated Topping Cycle (ITC) project, TRW was given the responsibility to organize, charter and co-chair, with the Department of Energy (DOE), and MHD Technology Transfer, Integration and Review Committee (TTIRC). The Charter of the TTIRC, which was approved by the DOE in June 1988 and distributed to the committee members, and the responsibilities and procedures of the committee are included as Appendix A. The TTIRC consists of an Executive Committee (EC), which acts as the governing body, and a General Committee (GC), also referred to as the main or full committee, consisting of representatives from the various POC contractors, participating universities and national laboratories, utilities, equipment suppliers, and other potential MHD users or investors. As stated in the Charter, the purpose of the TTIRC is to: (1) review all Proof-of-Concept (POC) projects and schedules in the national MHD program; to assess their compatibility with each other and the first commercial MHD retrofit plant; (2) establish and implement technology transfer formats for users of this technology; (3) identify interfaces, issues, and funding structures directly impacting the success of the commercial retrofit; (4) investigate and identify the manner in which, and by whom, the above should be resolved; and (5) investigate and assess other participation (foreign and domestic) in the US MHD Program. The sixth semi-annual status report of the MHD Technology Transfer, Integration and Review Committee (TTIRC) summarizes activities of the TTIRC during the period October 1990 through March 1991. It includes a summary and minutes of the Executive Committee meeting, progress summaries of ongoing POC contracts, discussions pertaining to technical integration issues in the POC program, and planned activities for the next six months.

3003 Thermoelectric Generators

18677 (ANL–91/45) **Sodium Heat Engine Development Program: Phase 1, Final report.** Singh, J.P.; Kupperman, D.S.; Majumdar, S.; Dorris, S.; Gopalsami, N.; Dieckman, S.L.; Jaross, R.A.; Johnson, D.L.; Gregar, J.S.; Poeppel, R.B.; Raptis, A.C.; Valentin, R.A. Argonne National Lab., IL (United States). Jan 1992.

138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012398. Source: OSTI; NTIS; GPO Dep.

The Sodium Heat Engine (SHE) is an efficient thermoelectric conversion device which directly generates electricity from a thermally regenerative electrochemical cell that relies on the unique conduction properties of β''-alumina solid electrolyte (BASE). Laboratory models of a variety of SHE devices have demonstrated the feasibility and efficiency of the system, engineering development of large prototype devices has been slowed by a series of materials and fabrication problems. Failure of the electrolyte tubes has been a recurring problem and a number of possible causes have been postulated. To address these issues, a two-phase engineering development program was undertaken. This report summarizes the final results of the first phase of the program, which included extensive materials characterization activities, a study of applicable nondestructive evaluation methods, an investigation of possible stress states that would contribute to fracture, and certain operational issues associated with the electromagnetic pumps used in the SHE prototype. Mechanical and microstructural evaluation of commercially obtained BASE tubes revealed that they should be adequate for SHE applications and that sodium exposure produced no appreciable deleterious strength effects. Processing activities to produce a more uniform and smaller grain size for the BASE tubes were completed using isostatic pressing, extrusion, and slip casting. Green tubes were sintered by conventional and microwave plasma methods. Of particular interest is the residual stress state in the BASE tubes, and both analysis and nondestructive evaluation methods were employed to evaluate these stresses. X-ray and neutron diffraction experiments were performed to determine the bulk residual stresses in commercially fabricated BASE tubes; however, tube-to-tube variations and variations among the various methods employed did not allow formulation of a definitive definition of the as-fabricated stress state.

18678 (DOE/SF/18852–T13) **GPHS-RTGs in support of the CRAF/Cassini missions: Semi-annual technical report, 30 September 1991–29 March 1992.** General Electric Co., Philadelphia, PA (United States). Astro Space Div. 20 Apr 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-91SF18852. Order Number DE92012302. Source: OSTI; NTIS; GPO Dep.

The technical progress achieved during the period 30 September 1911 through 29 March 1992 on Contract DE-AC03-91SF18852.000 Radioisotope Thermoelectric Generators and Ancillary Activities is described in this document. This report is organized by the program task structure as follows: spacecraft integration and liaison, engineering support, safety, qualified unicouple production, ETG fabrication, assembly and test, ground support equipment (GSE), RTG shipping and launch support, designs, reviews, and mission applications, project management, quality assurance, reliability, contract changes, and non-capital CAGO, and CAGO acquisition (Capital Funds).

18679 (LA-UR–92-869) **Recent developments in thermoacoustically-driven low-frequency projectors.** Ward, W.C.; Merrigan, M.A. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205140–1: 3. international workshop on transducers for sonics and ultrasonics, Orlando, FL (United States), 6-8 May 1992). Order Number DE92011370. Source: OSTI; NTIS; GPO Dep.

Thermoacoustic engines are a recent class of devices that can efficiently convert heat to acoustic energy without moving parts or intervening mechanisms. These engines have a natural potential for powering low-frequency sonar projectors with high reliability and efficiencies that cannot be matched by conventional technologies. A recent design study has produced thermoacoustic projector configurations that can execute standard projector performance requirements such as FM sweep and velocity magnitude and phase control in array environments for a wide range of positive and negative radiation resistances. The thermoacoustic driver is a vertically oriented, helium-filled resonator that contains a movable tuning element to vary the resonator frequency. It is coupled to a variable length water column that is tunable by a similar means to adjust the effective source impedance of the device. Modeling results indicate a sweep range of at least an octave for a single device, and maximum overall (heat-to-acoustic) conversion efficiencies of 25% at 50 Hz. Efficiency increases slightly at lower frequencies, and the lowest operational frequency is limited only by the size of the projector. Output power increases linearly with mean pressure, and at depths of 200 m or more, power densities in excess of 500 kW/m^2 are achievable. Control aspects have been investigated, including rapid startup and shutdown that can be performed by manipulating the water tuning column. Future trends and development prospects are discussed. 4 refs.

3005 Fuel Cells

18680 (LA-UR–92-984) **Batteries and fuel cells working group report.** Eberhardt, J. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Office of Advanced Transportation Materials); Landgrebe, A.; Lemons, R.; Wilson, M.; MacAurther, D. Los Alamos National Lab., NM (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9112112–1: Surface processing applications to transportation and utilities technologies, Washington, DC (United States), 10-12 Dec 1991). Order Number DE92011493. Source: OSTI; NTIS; GPO Dep.

Electrochemical energy systems are dominated by interfacial phenomena. Catalysis, corrosion, electrical and ionic contact, and wetting behavior are critical to the performance of fuel cells and batteries. Accordingly, development of processing techniques to control these surface properties is important to successful commercialization of advanced batteries and fuel cells. Many of the surface processing issues are specific to a particular electrochemical system. Therefore, the working group focused on systems that are of specific interest to DOE/Conservation and Renewable Energy. These systems addressed were: Polymer Electrolyte Membrane (PEM) Fuel Cells, Direct Methanol Oxidation (DMO) Fuel Cells, and Lithium/Polymer Batteries. The approach used by the working group for each of these systems was to follow the current path through the system and to identify the principal interfaces. The function of each interface was specified together with its desired properties. The degree to which surface properties limit performance in present systems was rated. Finally, the surface processing needs associated with the performance limiting interfaces were identified. This report summarizes this information.

18681 (TKK-KO/LTK–66) **A mathematical model for metal hydride electrodes.** Viitanen, M. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering. 1991. 19p. Order Number DE92506506. Source: OSTI; NTIS (US Sales Only).

A model describing the discharge process of a metal hydride electrode is developed. The electrode is used as an anode in different types of electrochemical cell. The electrode studied is cylindrical and the metal hydride is in the form of powder. In the model the electrode consists of spherical particles with electrolyte between the particles. A special case of the model is considered to demonstrate the maximum current density which can be obtained from the metal hydride electrode, i.e. in the most favourable circumstances, where the only limiting factor is the diffusion of hydrogen in metal.

18682 (TKK-KO/LTK–67) **Experimental study of cylindrical air electrodes.** Viitanen, M.; Lamminen, J.; Lampinen, M.J. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering. 1991. 13p. Order Number DE92506507. Source: OSTI; NTIS (US Sales Only).

The electrodes studied here are cylindrical and prepared to be placed inside the inner surface of a sintered brass tube, which is nickel-plated. Previously we have reported on the preparation of flat air electrodes and also on long run tests carried out with these electrodes 11,21. The electrode material was prepared by the so-called wet method to obtain a carbon dough which is easy to handle. The material preparation remains the same, but owing to the different geometrical shape, the preparation of the electrode itself is quite different. We have studied here the long-term performance of these new cylindrical air electrodes and at the same time measured the carbonate content of the electrolyte. We have also analysed by comparative methods which property of the electrode lowers the performance after a fairly long period.

18683 Electric power producing system using molten carbonate type fuel cell. Kobayashi, Kazunori; Yoshida, Toshiaki. To Ishikawajima-Harima Heavy Industries Co. Ltd. (Japan). 11 Nov 1991. Filed date 11 May 1990. Canada Patent patent application 2016536. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An electric power producing system comprises a molten carbonate fuel cell whose anode chamber is provided with hydrogen gas and whose cathode chamber is provided with air and carbon dioxide, a reformer including a reforming chamber for reforming fuel gas into anode gas, and a combustion chamber for maintaining the temperature of the reforming chamber. In the reformer, fuel gas (such as natural gas) and steam are fed into the reforming chamber, gases discharged from the anode chamber are introduced into the combustion chamber, non-reacted gases in the anode exhaust gas are burned with air, and heat produced during combustion is used to heat the reforming chamber. Hydrogen-rich gas made in the reforming chamber is fed into the anode chamber, air is introduced into the cathode chamber, the cathode exhaust gas is partially fed into the combustion chamber while the remainder is discharged from the system, and combustion gas from the combustion chamber is separated from water and then recirculated into the cathode chamber. The anode exhaust gas is directly introduced into the combustion chamber so that the anode and cathode chambers are made substantially equal to each other in pressure. 2 figs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 18595, 18596

18684 (DOE/CE–0350) **Report on the feasibility of coupling research and marketing strategies.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Nov 1991. 59p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012387. Source: OSTI; NTIS; GPO Dep.

The Senate Committee on Appropriations requested in its Committee Report on the FY1991 Appropriations for Interior and Related Agencies (P.L.101–534) that the Department of Energy prepare a report on the "feasibility of coupling research and marketing strategies more closely, especially for the buildings and community systems program." This report is submitted in response to that request. The mission of the Office of Conservation and Renewable Energy (CE) is to develop and promote the adoption of cost-effective renewable energy and energy efficiency technologies and practices in conjunction with the States and with partners in the transportation, industrial, utility, and building sectors for the benefit of economic competitiveness, energy security, and environmental quality. To achieve this mission, basic and applied research is conducted on a variety of promising technologies with near- and long-term potential for making a contribution to the country's energy supply. The ultimate goal of this research is the transfer and commercialization of successful renewable and energy efficiency technologies to the targeted end- users. As such, marketing is an integral and critical component of CE's overall R&D strategy. Marketing within Ce is integrated into the process of developing a technology from concept to commercialization. For a new technology to successfully enter the marketplace as a viable competitor, marketing must occur throughout the Research and Development (R&D) process to tailor the technology's development to the needs of the end-users and the characteristics of the market. The CE marketing effort can be thought of as a continuum, a chain of activities that serve to stimulate industry involvement in the development of new technologies and maximize their eventual commercial acceptance.

18685 (NEI-NO–212) **Energy conservation and solar energy: Summary of research reports 1984 - 1989.** Norges Teknisk-Naturvitenskapelige Forskningsraad, Oslo (Norway). 1990 26p. (In Norwegian). Order Number DE92506549. Source: OSTI; NTIS (US Sales Only).

This report is a compilation of research reports in the fields of energy conservation and solar energy. It comprises 25 reports within energy conservation and 33 reports within solar energy from the period 1984 - 1989.

3201 Buildings

Refer also to citation(s) 18171, 18187, 18247, 18589, 18593, 18648, 18667, 18672, 18739, 18771, 19468

18686 (BFR-D–20-91) **Buildings and health: Indoor climate and effective energy use.** Johnson, B.G.; Kronvall, J.; Lindvall, T.; Wallin, A.; Weiss Lindencrona, H. Swedish Council for Building Research, Stockholm (Sweden). [1991]. 176p. Order Number DE92506621. Source: OSTI; NTIS (US Sales Only).

The indoor climate in our dwellings, offices, schools and other premises is of decisive importance for the health and well-being of their occupants. Health and comfort problems associated with the indoor climate have, however, come to constitute a major problem in recent years. A conclusion is that the hygienic and climatic requirements frequently are neglected, and that they must reassume a central position in the building and building management process. Greater demands must be made on the quality of materials, on responsibility and competence in the building process and on the overall strategy for energy conservation in conjunction with both new construction and modernization. Present-day knowledge of health problems associated with the indoor climate and an overview of the possibilities to solve these problems are presented in this knowledge survey.

18687 (BFR-R–8-92) **Energy requirement and indoor thermal climate in buildings with different thermal capacity.** Soedergren, D. (TETEX Konsulter AB, Solna (Sweden)); Isfaelt, E.; Vinberg, H.A. Swedish Council for Building Research, Stockholm (Sweden). 1992. 27p. (In Swedish). Project BFR-870860-9. Order Number DE92506623. Source: OSTI; NTIS (US Sales Only).

This study points to the influence of different factors on the annual energy requirement and on the indoor thermal climate in a building, designed as a typical single-story building for light industry or storage. The results are shown with numerical values and diagrams. As expected, the well-known factors, e g those that should be considered following given standards, turn out to have appreciable influence. They are thermal insulation, window area, window type, sun shades, ventilation, air tightness and internal heat production. The influence of thermal capacity is less pronounced in these studies. Other factors, which in other studies have been found to have considerable influence, are the inhabitants behavior regarding window ventilation, opening of doors, use of electrical light etc and also local climate regarding wind and temperature. They are not studied here. It is important to point out, that the studies are made on ordinary, conventional buildings, without special systems for energy saving or control. Special systems, using heavy parts of the building for storage of heat and cold, might give other results. Also buildings with good thermal insulation and special control of the temperatures, can give differing results. Knowledge of the influence of materials and design is the foundation for designing good buildings and good systems for building. We hope that this study can add to this knowledge. 6 refs., 8 figs.

18688 (CONF-9205134–1) **Thermal conductivity of polyisocyanurate foam board insulation blown with CFC-11 substitutes: Laboratory and long-term field measurements.** Courville, G.E.; Christian, J.E.; Graves, R.S. Oak Ridge National Lab., TN (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States); Society of the Plastics Industry, New York, NY (United States); Polyisocyanurate Insulation Mfrs. Association, Deerfield, IL (United States); National Roofing Contractors Association, Chicago, IL (United DOE Contract AC05-84OR21400. From 8. international roofing and waterproofing congress; Madrid (Spain); 20-22 May 1992. Order Number DE92010544. Source: OSTI; NTIS; GPO Dep.

This paper reports on a series of laboratory and controlled test site measurements of the thermal conductivity of polyisocyanurate foam laminated boardstock roof insulations produced with several different blowing agents; CFC-11, HCFC-123, HCFC-14lb, and two blends of the HCFCs. The behavior of the experimental foams with HCFCs is compared to that of conventional polyisocyanurate foam blown with CFC-11. Thermal drift observed from two years of field exposure is compared to laboratory accelerated aging tests and the laboratory and field measurement techniques are described. This work is part of a Joint Industry/Government Project established in the United States to evaluate the technical viability of HCFC alternative blowing agents for polyisocyanurate foam roof insulations.

18689 (DOE/BP–1217) **Japanese refrigerators field testing.** Lou, A.T. USDOE Bonneville Power Administration, Portland, OR (United States). Residential Technology Section. Mar 1989. 9p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013350. Source: OSTI; NTIS; GPO Dep.

Residential refrigerators consume the equivalent of 1700 megawatts (MW) of baseload power in the Bonneville Power Administration (BPA) service area. Japanese manufacturers have designed refrigerator units that appear more energy efficient than some currently available American models. This report summarizes preliminary findings from field testing of 12 refrigerators of Japanese manufacture to evaluate annual kilowatt hour (kWh) use during actual operation. The units have also undergone laboratory testing sponsored by BPA at ETL Testing Laboratories, Inc. in Cortland, New York. A final report of the project – due at the end of 1989 – will correlate in detail the results of field and laboratory tests in comparison to performance ratings determined by the manufacturer.

18690 (DOE/BP–1687) **Air-leakage control manual.** Maloney, J. (Washington State Energy Office, Olympia, WA (United States)). USDOE Bonneville Power Administration, Portland, OR (United States); Washington State Energy Office, Olympia, WA (United States). May 1991. 44p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011543. Source: OSTI; NTIS; GPO Dep.

This manual is for builders and designers who are interested in building energy-efficient homes. The purpose of the manual is to provide the "how and why" of controlling air leakage by means of a system called the "Simple Caulk and Seal" (SIMPLE-CS) system. This manual provides an overview of the purpose and contents of the manual; it discusses the forces that affect air leakage in homes and the benefits of controlling air leakage. Also discussed are two earlier approaches for controlling air leakage and the problems with these approaches. It describes the SIMPLE--CS system. It outlines the standard components of the building envelope that require sealing and provides guidelines for sealing them. It outlines a step-by-step procedure for analyzing and planning the sealing effort. The procedure includes (1) identifying areas to be sealed, (2) determining the most effective and convenient stage of construction in which to do the sealing, and (3) designating the appropriate crew member or trade to be responsible for the sealing.

18691 (DOE/BP–1787) **An analysis of predicted vs monitored space heat energy use in 120 homes: Residential Construction Demonstration Project Cycle 2.** Douglass, J.G.; Young, M. Washington State Energy Office, Olympia, WA (United States). Oct 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC79-85BP23821. Order Number DE92013340. Source: OSTI; NTIS; GPO Dep.

The SUNDAY thermal simulation program was used to predict space heat energy consumption for 120 energy efficient homes. The predicted data were found to explain 43.8 percent of the variation in monitored space heat consumption. Using a paired Student's to test, no statistically significant difference could be found between mean predicted space heat and monitored space heat for the entire sample of homes. The homes were grouped into seven classes, sub-samples by total heat loss coefficient. An intermediate class (UA = 300–350 Btu/°F) was found to significantly over-predict space heat by 25 percent. The same class was over-predicted by 16 percent in the analogous Cycle 1 research, but the sample size was smaller and this was not found to be statistically significant. Several variables that were not directly included as inputs to the simulation were examined with an analysis of covariance model for their ability to improve the simulation's prediction of space heat. The variables having the greatest effect were conditioned floor area, heating system type, and foundation type. The model was able to increase the coefficient of determination from 0.438 to 0.670; a 54 percent increase. While the SUNDAY simulation program to aggregate is able to predict space heat consumption, it should be noted that there is a considerable amount of variation in both the monitored space heat consumption and the SUNDAY predictions. The ability of the program to accurately model an individual house will be constrained by both the quality of input variables and the range of occupant behavior. These constraints apply to any building model.

18692 (DOE/BP/10392–1) **Pacific Northwest Nonresidential/Commercial Energy Survey (PNNonRES): Phases 1 and 2 descriptive data analysis report: Final report.** Baker, Reiter and Associates, Seattle, WA (United States). Dec 1991. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC79-90BP10392. Order Number DE92011097. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest Nonresidential Energy Survey (PNNonRES) was a two-phase survey of nonresidential buildings in Idaho, Oregon, Washington, and Western Montana. In Phase 1, 15,250 nonresidential buildings, comprising a statistical sample of the population of nonresidential buildings in the Pacific Northwest, were enumerated. Phase 2, on-site surveys were conducted of a sample of 621 of the commercial buildings enumerated in Phase 1. In Phase 1, each building had a "walk-by" survey. In addition, the utility type (public, private) of each building was determined. In Phase 2, the Phase 1 information (except for type of development) was recollected. Information about the following additional characteristics was also collected for each building. Predominate fuel and equipment type used for heating, cooling, and water heating; heated, cooled, and refrigerated floor area; indoor and outdoor lighting capacity; and, wall, door, window, roof, and skylight area and material. In addition, partial surveys were conducted of the buildings sharing electric or gas service with each of the sampled buildings, and the electric and natural gas bills for each of the "shared service areas" were collected.

18693 (DOE/CH/10224–T3) **ECM monitoring study, states of Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin: Final summary report.** Globetrotters Engineering Corp., Chicago, IL (United States). 15 Aug 1986. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-84CH10224. Order Number DE92011578. Source: OSTI; NTIS; GPO Dep.

The purposes of the energy conservation measures (ECM's) monitoring program are to: (1) determine if the grants are being conducted in accordance with the ICP regulations and with the terms and conditions of federal financial assistance programs in general; (2) determine if the grantees are on schedule and within budget; (3) ascertain whether required operation and maintenance procedures have been implemented; (4) where appropriate, identify any deviations from funded ECM's; (5) report on any energy savings being realized from the implementation of the operation and maintenance procedures and the funded ECM's; and (6) comment on the general progress of the grantees as a group.

18694 (DOE/SF/17960–T12) **Energy Efficient Industrialized Housing Research Program: Annual report, FY 1991.** Oregon Univ., Eugene, OR (United States). Center for Housing Innovation; Florida Solar Energy Center, Cape Canaveral, FL (United States). Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC03-89SF17960. Order Number DE92011331. Source: OSTI; NTIS; GPO Dep.

Six area reported progress in the Energy Efficient Industrialized Housing Research Program during FY 1991. As part of Industry Guidance, meetings were held with steering and technical committees in computers, housing design and manufacturing. This task area enables the program to benefit from the expertise of industry representatives and communicate research results directly to them. As part of the Design Process performance specifications were being developed for the future housing system designed last year. These house designs coordinate and optimize predicted and desirable advances in computerized design processes, materials, components, and manufacturing automation to achieve energy efficiency at reduced first cost. Energy design software were being developed for CAD systems, stressed skin insulating core panel manufacturers; and a prototype energy sales tool. A prototype design was to be developed to integrate one or more subsystems with the building skin. As part of the Manufacturing Process we are developing a manufacturing process simulation and data base to help current and new entrants to the industrialized housing industry in assessing the impact of implementing new manufacturing techniques. For Evaluation we are developing testing plans for six units of housing on the UO campus and the stressed skin insulating core house to be constructed in Oregon. The DOW Chemical test structure will be retrofitted with a tile roof and retested to compare to the dome and conventional construction structures. Calibration of the wind tunnel will be completed so that laboratory tests can be conducted to simulate the ventilation cooling efficiency of houses in design. Research utilization and program management were either aspects of this program.

18695 (DTH-LV-MEDD–192) **Fresh air supply in airtight, well insulated houses.** Energiministeriets Forskningsprogram. Energianvendelse i bygninger. Wittchen, K. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Dec 1988. 31p. (In Danish). Contract EM-22411-405-02-01. Order Number DE92506374. Source: OSTI; NTIS (US Sales Only).

Paa omslaget: Friskluftforsyning i taette, velisolerede bygninger. EFP-84.

Modern Danish houses are often built with a great respect for insulation and air tightness. Because of this it can be necessary to install mechanical ventilation systems in order to obtain a good indoor air quality. To meet the demand for low energy consumption, air-to-air heat exchangers are often added to the ventilation systems. Heat exchangers typically operate with a thermal efficiency of 0.6-0.7. However it is possible to achieve further energy savings by preheating the cold ventilation air before it reaches the heat exchanger. This preheating could be achieved by leading the cold air through surroundings with a temperature higher than the external air temperature. Surroundings of this kind can be found in attics, crawl spaces, underground ducts etc. Analysis have been made of the preheating of the ventilation air in 3 of 6 monitored low energy houses at Hjortekaer, about 20 km north of Copenhagen. The houses each had different types of ventilation systems with heat exchangers, namely preheating in an attic, preheating in a crawl space and a traditional simple ventilation system in a low energy house. Furthermore, a theoretical analysis of the preheating in an underground duct system has been made. Investigations showed that compatibility is best between heating demand and possible energy gain when the preheating comes from a ground-connected system (crawl spaces or an underground duct system). Ventilation systems of this type will, beside the preheating gains, offer the opportunity of cooling the house in periods with high ambient temperatures. (AB) 57 p.

18696 (ENET–8900564/1) **O_2 control in the ETH Centre and ETH Hoenggerberg piped heating system.** Good, J. (Eidgenoessische Technische Hochschule, Inst. fuer Energiesysteme, Zuerich (CH)). Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Feb 1991. 71p. Order Number DE92515355. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

This final report presents the results of measurements in the ETH Hoenggerberg heat station and in the ETH Centre piped heating system. The measurements included oxygen, carbon monoxide and carbon dioxide, nitroxides, flue gas temperature and ambient temperature. Measures to reduce the nitroxides in the ETH Centre system were taken on the basis of the measurement results.

18697 (ENET–8990020/2) **Electricity measurement methods.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Oct 1990. 78p. (In German). Order Number DE92515351. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The aim of this study, which was commissioned by the Swiss Federal Office of Energy is to describe and assess the status of international research into electricity consumption measurement methods. The gaps in our knowledge are to be shown and new research projects proposed for this field. The study is restricted to methods for measuring the electricity requirements of devices, systems and buildings. Measurement equipment which are used to monitor process or form part of control systems are not included in the study. (author) figs., tabs., 32 refs.

18698 (ENET–9100306/3) **Vademecum of construction ecology.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Apr 1991. 24p. (In German). Order Number DE92515360. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

The vademecum consists of a composition of selected literature on the subject of construction ecology and of a list of Swiss projects. refs.

18699 (ETDE-IT–92-22) **Heating system automated control: Italian ENEA's experience.** Baldotti, R.; Guerra, B. ENEA, Casaccia (Italy). Area Energetica. 1991. 6p. (In Italian). (CONF-9111217–1: L'Europa dei teleservizi tecnici: le esperienze dei gestori e le prospettive di sviluppo, Rome (Italy), 21-22 Nov 1991). Order Number DE92506239. Source: OSTI; NTIS (US Sales Only).

This paper reports on progress being made by ENEA (Italian National Agency for New Technologies, Energy and Environment) in promoting, within the framework of Italian energy conservation legislation, the use of computerized building HVAC system energy management systems in the public service sector. The promotional work involves: the setting up and management of demonstration programs in schools, government office buildings, etc.; the recording of heating and air conditioning plant cost-performance data; the optimization of computerized management system design and management methods; the creation of network control systems to manage energy consumption of groups of buildings. The automated systems are to take into account ambient temperature variations, as well as, internal zone temperatures in order to optimize heating plant operation times and building thermal comfort.

18700 (ETDE-mf–92506987) **Evacuated superinsulation (DESIS) under pressure. Final report.** Fricke, J.; Buettner, D.; Caps, R. Wuerzburg Univ. (Germany). Physikalisches Inst.; Bundesministerium fuer Forschung und Technologie, Bonn (Germany). 31 Dec 1989 102p. (In German). Contract BMFT 03E8654A. Order Number DE92506987. Source: OSTI; NTIS (US Sales Only).

The research project DESIS involved the investigation of non-evacuated and evacuated thermal insulations from powders, fibers, gels and foams. It was pursued in order to save energy in heat and cold storage as well as transport systems. A second goal was the substitution of environmentally harmful and hazardous insulation materials. The research program aimed at the reduction of the radiative transport, the solid and gaseous conduction. It involved caloric investigations as well as infrared optical transmission and reflection measurements. Ultrasonic measurements served to characterize the solid conduction. Optimized insulations in the program DESIS show specific extinctions > 100 m^2/kg. Peg-supported insulations have effective solid conductivities below 0.001 W/(mxK). As the most important application the substitution of CFC-blown polyurethane foams by opacified aerogel powders ought to be mentioned. For passive solar usage transparent thermal insulations are of special interest. (orig./BWI) With 41 refs., 1 tab., 50 figs.

18701 (IBP-FB–32/1991) **Physical investigation in heated and unheated building of the old construction method. Pt. A. Physical bases and general connections of temperature and moisture conditions based on long-time tests.** Kuenzel, H.; Holz, D. Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany). 1991. 88p. (In German). Order Number DE92516783. Source: OSTI; NTIS (US Sales Only).

The heating of old formerly not heated buildings which often have metres thick walls may due to microclimate changes lead to damage on furnishings. For this reason such buildings are often not heated, but this counteracts contemporary use. As part of a research project the effects of heating have been investigated. It showed that heating of buildings is in principle advantageous for the preservation of the building structure and of furnishings. But heating according to today's climate standards for rooms which are intended for permanent occupancy is not possible. (BWI).

18702 (NEI-DK-774) **Jelling energy project.** Bakkelandets Energikontor, Braedstrup (Denmark). [1991] 49p. (In Danish). Contract TR-89.0373;Contract ENS-UVE-90.0099. Order Number DE92506315. Source: OSTI; NTIS (US Sales Only).

The local authorities in the Jelling administrative area in Denmark give priority to environmental protection and wish the area to be "green". One of the activities that have been instigated in this relation is the surveying of energy consumption patterns in 250 houses and buildings with the aim of investigating the feasibility of retrofitting existing buildings so that they use only the minimum of energy and make optimal use of renewable energy sources. Another aim was to inform local builders of the potentials for constructing low energy houses and instruct them on the concept of low energy, and in fact to initiate an overall information dissemination on this subject. The procedure used in the energy surveys, a general description of low energy homes, tables illustrating energy savings and financing are presented in addition to a more detailed description of the concept of a "climatic shield" which protects buildings from the cooling effect of the local winds and cold temperatures. Various methods of thermal insulation are explained, and building techniques, materials and energy supplies are also dealt with. It is concluded that the project has had a significant effect on the attitudes of the local inhabitants. (AB).

18703 (NEI-DK-779) **Testing procedures for the determination of annual efficiency and annual emissions of domestic boilers.** Schweitzer, J.; Jacobsen, L.; Spiegelhauer, B. Dansk Gasteknisk Center A/S, Hoersholm (Denmark). May 1991 36p. Order Number DE92506308. Source: OSTI; NTIS (US Sales Only).

Testing procedures for the determination of annual efficiency and annual emissions of domestic gas boilers are presented. The purpose was to establish a firm basis for laboratory testing and analyses of results concerning annual efficiency, hot water production, emissions and quality of domestic gas boilers. The proposed procedures are consistent with current practice in Denmark. The procedure is suitable for gas boilers with a heat input of up to 70 KW. The value of heat output used for the calculation of load and efficiency is the heat that is delivered to the heating system to increase the room temperature and to produce hot water. The procedure can also be used to test control systems or other systems whose purpose is to conserve energy or increase comfort. It is based on the use of a boiler for heat and hot water production in a house with an annual consumption of 10 to 30 MWh for space heating and about 4 MWh for hot water. The standard of reference is a house whose heat losses are 8 KW at an outside temperature of -12 deg. C and an inside temperature of 20 deg. C. for hot water production, the standard of reference is a need of approximately 0.5 KW. This yields the values 20 MWh and 4 MWh. (AB) 10 refs.

18704 (NEI-DK-781) **Building for communal activities: Suggestions for maintenance and retrofitting taking ecology into consideration.** Planenergi S/I, Aarhus (Denmark). Jun 1991 28p. (In Danish). Contract ENS-UVE-90.0154. Order Number DE92506306. Source: OSTI; NTIS (US Sales Only).

An older five-storied house in the town of Haderslev, Denmark, is owned by the local authorities and used for communal activities. Suggestions are given as to how to maintenance this house and convert it in such a way that the environmental quality is preserved. The emphasis is on the energy conservation, in relation to heating, electric power and the use of hot water. (AB).

18705 (NEI-DK-782) **Catalogue of ecological elements in urban renewal.** Planenergi S/I, Aarhus (Denmark); Byfornyelsesselskabet Danmark, Copenhagen (Denmark). Oct 1991 98p. (In Danish). Contract ENS-UVE-90.0004. Order Number DE92506305. Source: OSTI; NTIS (US Sales Only).

The aim was to offer a basis for convincing owners that buildings can be retrofitted in such a way that ecological principles are taken into consideration. A selection of methods are presented with this aim in mind. A general explanation of administrative procedures is given. Different methods of space heating and various ways of achieving energy conservation and environmental protection in this repect, also with regard to electricity consumption and water heating, are described. (AB).

18706 (NEI-DK-783) **25 Slotsgade in Haderslev: Draft project for urban renewal, with ecological elements.** Planenergi S/I, Aarhus (Denmark). Jun 1991 30p. (In Danish). Contract ENS-UVE-90.0154. Order Number DE92506307. Source: OSTI; NTIS (US Sales Only).

The emphasis of this draft project on urban renewal is on energy conservation. Suggestions are made on methods of achieving this aim in the Danish town of Haderslev. The ecological strategy is explained - this has the character of improved maintenance. The patterns of the town's heat, electricity and water consumption are described and, in relation to these descriptions, suggestions are made as to methods of saving energy. (AB).

18707 (NEI-DK-796) **The insulated steel house: Measuring programme.** Bygge- og Miljoeteknik A/S, Copenhagen (Denmark). [1991] 119p. (In Danish, English). Contract TR-89.0096. Order Number DE92506333. Source: OSTI; NTIS (US Sales Only).

A description of a measuring programme established in order to compile data on a "steel house". This test house was constructed according to the theory that the foundation elements for the outside walls should be comprised of steel plates. These plates are calculated to conduct part of the excess summer heat down into the earth. This excess heat in the earth under and around the house could be used during the cold winter months as the steel plates would conduct the heat from the soil into the house walls again. This form of construction would also result in less temperature gradiency in relation to thermal insulation inside the steel walls - leading to less heat loss from the house through the walls. The amount of electric power consumption, temperatures and solar heat intensity were measured. The resulting data is included in the publication. (AB).

18708 (NEI-DK-802) **Heat recovery in relation to heat pumps in apartment buildings.** Esbensen Raadgivende Ingenioerer, Soenderborg (Denmark). Dec 1991 42p. (In Danish). Contract EM-22411-402-05-01. Order Number DE92506337. Source: OSTI; NTIS (US Sales Only).

EFP-84.

A description of how the heat in ventilation air in blocks of flats can be used for heating domestic water in the building with the help of heat pumps. The amount of expected heat to be found in the inlet air and how much of it can be used for the water heating is clarified, and the relevant heat pump system is described in detail. (AB).

18709 (NYSERDA-91-13) **Computerization of the New York State Weatherization Assistance Program: Final report.** Cherry, R.M. (New York Urban Coalition Housing Group, Inc., NY (United States)); Cohen, G.; Rodberg, L. New York State Energy Research and Development Authority, Albany, NY (United States); New York Urban Coalition Housing Group, Inc., NY (United States). Jun 1991. 341p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

The Weatherization Analysis and Management System (WAMS) is a comprehensive microcomputer-based system of energy analysis and program management designed for use by subgrantees in the New York State Weatherization Assistance Program. WAMS includes three principal sub-programs, a Weatherization Management System (WMS) which incorporates client intake and tracking, inventory tracking and control, subcontract management, and reporting functions, an energy audit program (EA-QUIP), and an energy savings analysis program (ES-QUIP). The goals of this project were: (1) to implement the WAMS software at 20 WAP subgrantees and train their staff in its use; (2) to improve the WAMS software to meet the operating and reporting needs of the participating agencies and WAP; and, (3) to prepare a plan for extending the WAMS software to all NYS WAP subgrantees.

18710 (VTT-ETRR-8) **Control of moisture during construction: Drying of concrete floor.** Nieminen, J.; Kauppi, A.; Salonvaara, M. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Building Materials Lab. 1991. 47p. (In Finnish). Order Number DE92506514. Source: OSTI; NTIS (US Sales Only).

ETRR Research Programme.

The drying of various concrete slabs and factors affecting it are studied computationally in the study. The finding of the study indicate that the drying can be significantly influenced by structural means, by controlling the drying conditions, and by the selection of the concrete quality. The drying of slabs-on-ground in a reasonable time requires good drying conditions. The limit values for the drying conditions can be regarded as a minimum temperature of 15 - 20 deg C and a maximum relative humidity of 60 %. The importance of the thickness of the concrete slab is then considerable, and thickness in excess of 80 mm should be avoided. The quality of the concrete has a bearing especially when the drying conditions are poor. As the condition improve, so the significance of the concrete quality declines. In the drying of floors, it is important to know the conditions on both sides of the floor. The temperature difference between each side of the floor has a considerable effect on the drying, and this must be taken into consideration, especially in the drying of face-concrete castings.

18711 (VTT-ETRR--9) **Low-energy small house: Part II.** Kouhia, I. (and others); Erat, B.; Luoma, K. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Building Materials Lab. 1991. 60p. (In Finnish). Order Number DE92506515. Source: OSTI; NTIS (US Sales Only).

ETRR Research Programme.

In an earlier stage of the project, low-energy small house solutions comprising energy-saving equipment and structural alternatives were conceptualized, and provisional calculations were made to compare the heating energy consumption and costs of the various house concepts. The target levels of heating energy consumption in the low-energy small houses were 75 %, 50 %, 25 % and less than 25 % of the heating energy consumption in a building representative of present-day construction methods. From the various low-energy small house solutions, one of each consumption category was selected for more detailed examination and design work. This report presents the results of this more detailed examination and planning with regard to architectural, structural and HVAC design as well as studies on heating energy consumption and costs. The results indicate that the consumption of energy in small houses can be halved without essentially changing the annual costs. Reducing energy consumption economically to below half the present level would require an increase in the price of energy of essential limitations in availability.

18712 (VTT-TIED--1303) **Repair and renovation work in the building sector: Part 5 Summary.** Lehtinen, E. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Building Production); Vainio, T. Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 37p. (In Finnish). Order Number DE92506501. Source: OSTI; NTIS (US Sales Only).

The study of repair and renovation in the building sector (KORVO 90) gives a general picture of repair and renovation work in Finland in 1990: the total value of repair and renovation, the age of buildings being under repair, the measures taken the performing sectors and the causes for repairs undertaken. The development of repairs and renovation in the 1990s is forecast with the help of this study. The Building Production Laboratory of Technical Research Centre of Finland (VTT) has done a corresponding study concerning the year 1982. The new study inquired more closely into the repair work of flats. Both studies were based on postal questionnaires and interviews. The results of these studies are comparable with each other and evaluate the development of building repair work in the 1980s. The results of the study have been published in five parts. This is the fifth part and it includes a summary of the results. The value of repair and renovation increased by 50 per cent in the 1980s being FIM 21 billion in the year 1990. The repair and renovation of terrace houses, block of flats and business buildings increased most.

18713 (VTT-TIED--1310) **Determination of required air exchange rates for residences.** Saari, M. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation). Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 123p. (In Finnish). Order Number DE92506499. Source: OSTI; NTIS (US Sales Only).

In this paper the required ventilation air flow rates in residences with different pollutant loads are considered. The calculative study was carried out by using the load data presented in the literature. The results of the study was applied in the development and dimensioning of demand controlled ventilation systems. When considering different load factors; human based odours, the odours of smoking, humidity loads and contaminant emissions of materials were taken into account. The required ventilation air flow rates in different load situations were determined to guarantee good indoor air quality and humidity conditions, and to prevent health risks due to material emissions, as well.

18714 (VTT-TIED--1315) **Building technology in Europe: Final report of the EURATEK project.** Kanko, T. (ed.) (Technical Research Centre of Finland, Espoo (Finland). Forest Products Lab.). Technical Research Centre of Finland, Espoo (Finland). 1991. 73p. (In Finnish). Order Number DE92506502. Source: OSTI; NTIS (US Sales Only).

The unification of EC standards will, starting in 1992, facilitate the export of industrial products from one EC country to another without the need for preliminary inspection in each country. The extension of a corresponding system to encompass the EFTA countries is also under preparation. The directive on building products is ready and its supplementary documents are under preparation. Finland does have an opportunity to participate on the Technical Committee of CENm which is working on the preparation of the necessary standards. The issue of determining conformity with standards has already been agreed by the EC and EFTA, and the organizations coordinating this, EOTC and EOTA, have been set up. Various forms of cooperation between the countries of Europe have also been created in the field of building research, e.g. ENBRI and EUROTECH. Finland has an opportunity to participate in the EC research programmes by raising funding corresponding to the EC share at home and finding partners from EC countries. The development of building components is breaking the bonds that have tied us to traditional materials. Industrialized building technology will make readymade components uniform, whether they be steel, concrete, timber, combination structures or composites.

18715 (WAOENG--89-63) **Savings from new oil furnaces: A study conducted as part of Washington State's Oil Help Program.** Davis, R. Washington State Energy Office, Olympia, WA (United States). Dec 1989. 36p. Sponsored by Washington State Energy Office, Olympia, WA (United States). DOE Contract FG01-89CE26597. Order Number DE92011822. Source: OSTI; NTIS; GPO Dep.

The Washington State Energy Office (WSEO) has been running the Oil Help program for three years. Originally operated as a loan program, Oil Help switched to rebates during the 1987 and 1988. Rebates for oil furnace replacements made up over 70 percent of rebate funds, which totaled about $1.3 million. WSEO Evaluation started research in summer of 1988, with the goal of including 100 new furnace households (with a control group of similar size) in the study. Our intention was to look at long-term oil consumption comparing each household with itself over the two periods. The final study group consists of 43 households and a control group of 87 households. The report begins with a review of related research. A discussion of research methodology, weather normalization procedure, data attrition, and important descriptive details follows. Changes in consumption for the new furnace and control groups are reported and are tested for significance. Finally, we discuss the implications of the results for the cost effectiveness of an oil furnace replacement.

18716 (WAOENG--89-67) **An analysis of predicted vs monitored space heat energy use in 83 homes: Residential Construction Demonstration Project.** Downey, P.K. Washington State Energy Office, Olympia, WA (United States). Aug 1989. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-89CE26597. Order Number DE92011821. Source: OSTI; NTIS; GPO Dep.

In 1983 the Northwest Power Planning Council (NWPPC) directed the Bonneville Power Administration to create the Residential Standards Demonstration Program to demonstrate actual construction using the Model Conservation Standards (MCS) and to collect cost and thermal data in residential structures. Much information was gained from that program, and as a consequence, the MCS were reevaluated and updated. A second program, the

Residential Construction Demonstration Project was created to further investigate residential energy efficiency measures for both cost and thermal performance. The Residential Construction Demonstration Project was administered by the Washington State Energy Office in conjunction with the Idaho Department of Water Resources, the Montana Department of Natural Resources and Conservation, and the Oregon Department of Energy. This analysis is based upon information collected during the first phase of the Residential Construction Demonstration Project (RCDP).

18717 (WAOENG-91-02) **Energy efficiency resources in existing residences served by natural gas in Washington State: General assessment of conservation costs.** Byers, R.; Quaid, M.; Schueler, V. Washington State Energy Office, Olympia, WA (United States). Dec 1990. 51p. Sponsored by Washington State Energy Office, Olympia, WA (United States). Order Number DE92011817. Source: OSTI; NTIS.

This report analyzes and tabulates the cost of energy efficiency measures as they apply to Washington's existing housing stock that depends on natural gas for space and water heat. The report focuses on estimating the cost of conserving therms of natural gas with efficiency measures. These costs are calculated from the economic perspective of a natural gas utility looking to make cost-effective utility investments. The cost of conserving therms of natural gas is calculated in a manner that permits comparison to the estimated cost of future gas suppliers. The analysis concentrates on weatherization or space heating measures, and measures that improve the efficiency of heating and using domestic hot water. Space heating and water heating are the two principal end-uses of natural gas in residences.

18718 (WAOENG-91-04) **Residential construction demonstration project, Cycle II: Active ventilation.** Washington State Energy Office, Olympia, WA (United States). [1991]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-89CE26597. Order Number DE92011826. Source: OSTI; NTIS; GPO Dep.

This report documents the analysis of the performance of natural and mechanical ventilation in Pacific Northwest homes. The analysis was part of Cycle II of the Residential Construction Demonstration Project, sponsored by Bonneville Power Administration (BPA). Since 1986, the Residential Construction Demonstration Project (RCDP) has sponsored the collection of data on energy efficient homes in the Pacific Northwest that comply with these new standards and requirements. Cycle II of RCDP was conducted between September 1987 and April 1990. It concentrated on energy innovations in homes built to the Super Good Cents specification. All of the test homes have electric heat and mechanical ventilation systems. Seven different types of active ventilation systems are represented in the homes. Three of these system types are equipped with heat recovery devices, and are represented in approximately a quarter of the test homes. The potential for both natural and mechanical ventilation was measured. Potential structural leakage was measured by blower door testing. Flow rate and operating time of mechanical ventilation systems were measured with flow hoods and hour meters. Actual ventilation was measured by using a passive tracer gas technique for several weeks during the heating season and at times of normal occupancy.

18719 (WAOENG-91-06) **Cost-effectiveness of compact fluorescent lighting: Retrofits for residential consumers in the Pacific Northwest.** Lesser, J.A.; Byers, R. Washington State Energy Office, Olympia, WA (United States). Mar 1991. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-89CE26597. Order Number DE92011825. Source: OSTI; NTIS; GPO Dep.

Compact fluorescent technologies have been steadily improving. There has been increased interest in utilizing compact fluorescents to provide cost-effective energy savings for electric utilities in the residential sector. Several utilities in the United States have already distributed compact fluorescents to consumers free of charge. This study assesses the cost-effectiveness of compact fluorescents from the perspectives of consumers and utilities in the Pacific Northwest, where electricity rates are, on average, the lowest in the United States. The study also assesses cost-effectiveness from a societal perspective. Secondary hearing impacts and the value of reduced emissions of pollutants are incorporated into the analysis. Results indicate that compact fluorescents are more likely to be cost-effective as the perspective upon which they are assessed is broadened. Thus, they are least likely to be viewed as cost-effective by consumers, more likely to be considered cost-effective from a utility perspective, and almost always cost-effective from a societal perspective. Given these differences, is is suggested that policies be developed to capture the societal benefits of compact fluorescent retrofits through alternative regulatory or market mechanisms.

18720 **Thermal building blocks.** Moreau, P. 16 Sep 1991. Filed date 16 Mar 1990. Canada Patent patent application 2012334. 21p. (In French). Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Blocks for constructing a wall resting upon a footing or foundation having thermal protection in the form of polystyrene panels integrated with the two lateral faces of a central structural core (cement blocks) are disclosed. The exterior and interior insulating panels of the blocks are horizontally and vertically out of phase with respect to the core such that during its assembly, the blocks are aligned in the U formed by the insulating panels horizontally passing the end of the core and vertically passing the top of the core. The length and width of the insulating panels takes into account that there will be no joint between the panels, but that the cores to which they are attached will have a certain joint thickness. The relationship between the dimensions of the panels and the core is such that the height of the panels is equal to the height of the core plus the thickness of the horizontal joint. The length of the panels is equal to the length of the core plus the thickness of the vertical joint. 8 figs.

18721 **Flue control device.** Hagan, G.E. 6 Sep 1991. Filed date 6 Mar 1990. Canada Patent patent application 2011602. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A flue control device is provided which improves the combustion efficiency of furnaces within safety guidelines and which is readily adjustable. The device comprises two interlocking pipe sections and a spiral coil having a diameter slightly less than the inner diameter of the pipe sections with a central opening along the axis of the spiral. One end of the spiral coil is secured to the first pipe section and the second end is secured to the second pipe section so that the spacing of the coils of the spiral and the angle of the blades may be modified by separating and twisting the two pipe sections. The pipe sections are in turn adapted to be installed in the furnace exhaust pipe. 3 figs.

18722 **Heat machine.** Beaini, P.; Douglass, P. 18 Apr 1991. Filed date 22 Mar 1991. Canada Patent patent application 2038928. 6p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A small vapor-compression heat pump system has been designed to produce domestic hot water. The unit consists of a small compressor, a 40-gallon storage tank with wraparound condenser, a simple efficient static evaporator which eliminates the use of motor-driven fans, and a secondary source of heat utilizing energy radiated from the compressor. A coil wrapped around the compressor transfers the heat to the tank via the thermosyphon effect. The unit is designed to absorb heat from indoor or outdoor air, and clip-on collector plates enable additional energy to be generated under certain conditions. The design allows a 195 watt compressor with a coefficient of performance of 2 to be adequate enough to raise the temperature of a 40-gallon tank by 80 degrees F. 2 figs.

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Refer also to citation(s) 18579, 18744, 20576

18723 (ANL/CP-74864) **Vehicle/guideway interaction for high speed vehicles on flexible guideway.** Cai, Y.; Chen, S.S.; Rote, D.M.; Coffey, H.T. Argonne National Lab., IL (United States). [1992]. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9206155-1:

1992 Canadian Society for Mechanical Engineering (CSME): Transport 1992+, Montreal (Canada), 1-5 Jun 1992). Order Number DE92013057. Source: OSTI; NTIS; GPO Dep.

Dynamic interactions between vehicles and guideways of a high speed ground transportation system based on magnetically levitated vehicles are studied with an emphasis on the effects of vehicle and guideway parameters. Two dynamic models for vehicles are presented: first, the vehicle is considered as a moving force traveling on a simply-supported single-span or two-span beams with various speeds; and second, the vehicle is considered as a one dimensional model with two-degrees-of-freedom which represents the primary and secondary suspensions of a vehicle with lumped masses, linear springs, and dampings. The Bernoulli-Euler beam equation is used to model the characteristics of a flexible guideway, and the guideway synthesis is based on a model analysis method. A series of analysis has been performed to understand the response characteristics under different loading conditions and provide some benchmark data for verifications of other comprehensive computer programs and some basic design guideline for maglev systems. 16 refs.

18724 (ANL/ESD–14) **Preliminary design for a maglev development facility.** Coffey, H.T. (Argonne National Lab., IL (United States)); He, J.L.; Chang, S.L.; Bouillard, J.X.; Chen, S.S.; Cai, Y.; Hoppie, L.O.; Lottes, S.A.; Rote, D.M.; Zhang, Z.Y.; Myers, G.; Cvercko, A.; Williams, J.R. Argonne National Lab., IL (United States). Apr 1992. 200p. Sponsored by USDOE, Washington, DC (United States); Illinois State Government, Springfield, IL (United States). DOE Contract W-31109-ENG-38. Order Number DE92012259. Source: OSTI; NTIS; GPO Dep.

A preliminary design was made of a national user facility for evaluating magnetic-levitation (maglev) technologies in sizes intermediate between laboratory experiments and full-scale systems. A technical advisory committee was established and a conference was held to obtain advice on the potential requirements of operational systems and how the facility might best be configured to test these requirements. The effort included studies of multiple concepts for levitating, guiding, and propelling maglev vehicles, as well as the controls, communications, and data-acquisition and -reduction equipment that would be required in operating the facility. Preliminary designs for versatile, dual 2-MVA power supplies capable of powering attractive or repulsive systems were developed. Facility site requirements were identified. Test vehicles would be about 7.4 m (25 ft) long, would weigh form 3 to 7 metric tons, and would operate at speeds up to 67 m/s (150 mph) on a 3.3-km (2.05-mi) elevated guideway. The facility would utilize modular vehicles and guideways, permitting the substitution of levitation, propulsion, and guideway components of different designs and materials for evaluation. The vehicle would provide a test cell in which individual suspension or propulsion components or subsystems could be tested under realistic conditions. The system would allow economical evaluation of integrated systems under varying weather conditions and in realistic geometries.

18725 (ANL/ESD/TM–24) **Present status of computational tools for maglev development.** Wang, Z.; Chen, S.S.; Rote, D.M. Argonne National Lab., IL (United States). Energy Systems Div. Oct 1991. 49p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013252. Source: OSTI; NTIS; GPO Dep.

High-speed vehicles that employ magnetic levitation (maglev) have received great attention worldwide as a means of relieving both highway and air-traffic congestion. At this time, Japan and Germany are leading the development of maglev. After fifteen years of inactivity that is attributed to technical policy decisions, the federal government of the United States has reconsidered the possibility of using maglev in the United States. The National Maglev Initiative (NMI) was established in May 1990 to assess the potential of maglev in the United States. One of the tasks of the NMI, which is also the objective of this report, is to determine the status of existing computer software that can be applied to maglev-related problems. The computational problems involved in maglev assessment, research, and development can be classified into two categories: electromagnetic and mechanical. Because most maglev problems are complicated and difficult to solve analytically, proper numerical methods are needed to find solutions. To determine the status of maglev-related software, developers and users of computer codes were surveyed. The results of the survey are described in this report. 25 refs.

18726 (ANL/ESD/TM–29) **Publications on maglev technologies.** He, J.L.; Coffey, H.T.; Rote, D.M.; Wang, Z. Argonne National Lab., IL (United States). Dec 1991. 86p. Sponsored by Department of Defense, Washington, DC (United States); Illinois State Government, Springfield, IL (United States); Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013296. Source: OSTI; NTIS; GPO Dep.

Magnetically levitated passenger-transportation vehicles, using attractive and repulsive magnetic forces, are currently in the development or prototype-revenue stages in Japan and Germany. The basic principles of these technologies have been understood for several decades, but their practical applications awaited advances in high-power electronic devices, modern controls, superconducting magnets, and improvements in our transportation infrastructures. A considerable amount of work was devoted to magnetic-levitation (maglev) transportation system in the late 1960s and the 1970s. Detailed development was sustained primarily in Germany and Japan. This listing of publications was begun as the initial phase of a design study for a maglev development facility sponsored by the State of Illinois. The listing has been continually updated under programs sponsored by the Federal Railroad Administration and the US Army Corps of Engineers. In 1991, the National Maglev Initiative issued 27 contracts for the study of technical issues related to maglev and four contracts for the definition of maglev systems. In December 1991, the Intermodal Surface Transportation Efficiency Act was enacted, mandating the development of a US-designed maglev system in a six-year period. This listing is offered as an aid to those working on these projects, to help them locate technical papers on relevant technologies. The design and installation of a maglev transportation system will require the efforts of workers in many disciplines, from electronics to economics to safety. Accordingly, the references have been grouped in 14 different sections to expedite review of the listing. In many case, the references are annotated to indicate the general content of the papers. Abstracts are not available. A list of information services from which the listed documents might be obtained and an author index are provided.

18727 (EGG-PHY–9978) **Application of reactor-pumped lasers to power beaming.** Repetti, T.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012370. Source: OSTI; NTIS; GPO Dep.

Power beaming is the concept of centralized power generation and distribution to remote users via energy beams such as microwaves or laser beams. The power beaming community is presently performing technical evaluations of available lasers as part of the design process for developing terrestrial and space-based power beaming systems. This report describes the suitability of employing a nuclear reactor-pumped laser in a power beaming system. Although there are several technical issues to be resolved, the power beaming community currently believes that the AlGaAs solid-state laser is the primary candidate for power beaming because that laser meets the many design criteria for such a system and integrates well with the GaAs photodiode receiver array. After reviewing the history and physics of reactor-pumped lasers, the advantages of these lasers for power beaming are discussed, along with several technical issues which are currently facing reactor-pumped laser research. The overriding conclusion is that reactor-pumped laser technology is not presently developed to the point of being technially or economically competitive with more mature solid-state technologies for application to power beaming. 58 refs.

18728 (ENET–8990021/2) **Infosolar 1990 annual report.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). 1991. 10p. (In German). Order Number DE92515346. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

This article reports on the activities of the four consultation and information offices of INFOSOLAR in Bellinzona, Brugg, Columbier and Tanikon during 1990. These offices give information on energy saving measures, new energy forms such as passive and active solar energy use, energy from biomass, wind energy, heat pumps, photoelectric cells and geothermal energy.

18729 (LITH-MAT-R-92-02) **Some stochastic models in the traffic area.** Hjorth, U. Linkoeping Univ. (Sweden). Dept. of Mathematics. Jan 1992. 26p. (In Swedish). Order Number DE92506618. Source: OSTI; NTIS (US Sales Only).

A selection of stochastic models for traffic flows, capacities, mode choice, and traffic accidents is surveyed in this paper. 56 refs.

18730 (NEI-DK-829) **Optimization of propulsion properties for 4000 TDW cargo vessel.** Pucill, F. (Danish Maritime Institute (DK)); Johansson, B.; Haahr, A. Nordsoevaerftet A/S, Ringkoebing (Denmark). [1991] 53p. Contract ENS-151/90-0008. Order Number DE92506393. Source: OSTI; NTIS (US Sales Only).

EFP-90.

Nordsoevaerftet A/S has a long tradition in the design and building of smaller, self-sustained standard coasters. This all started in 1966 with the building of the first of 61 shelterdeckers of 299 BRT and further developed into the building of 499 BRT shelterdeckers and 1599 BRT closed shelterdeckers. Important characteristics for all these vessels are the provision of self-loading/unloading equipment in the form of cranes or derricks and the ability to undertake long voyages of 4000-8000 sea miles. A typical speed for these vessels 10 years ago was 7-9 knots. Today, market requirements require much faster speeds and it has therefore been necessary to depart from the typical, fullcoaster lines with Cb = 0.83. Today the lines are finer, with a Cb = 0.75, and a bulbous bow has been introduced. These radical changes in the hull lines have now been introduced by Nordsoevaerftet with support from model test facilities, including Danish Maritime Institute (DMI). Many ideas have been considered and tried out in model scale. In order to verify the Yard's ideas for improvement, DMI were asked to carry out a series of model tests, covering a much larger scope than has hiterto been normal for a standardcoaster. This optimization process, using as basis a hull form that was better than the average of similar vessels tested at DMI, has resulted in an average reduction of the power requirement in service speed of 12%. Alternatively it can be stated that the top speed of the vessel is increased by 3% for the same maximum power of the main engine. (au).

18731 (UCRL-ID-109860) **NASA High Speed Research Program, Emissions Scenarios Committee report of meetings on September 26, 1991 and January 9, 1992.** Wuebbles, D.J. Lawrence Livermore National Lab., CA (United States). 23 Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012409. Source: OSTI; NTIS; GPO Dep.

An important step in the process of assessing the environmental effects of possible future High-Speed Civil Transports (HSCTs) is the definition of scenarios for the emissions from a fleet of such aircraft. These scenarios are then used in numerical models of the chemistry and physics of the global atmosphere to determine potential environmental effects, including concerns about changes in ozone and in climate. The Emissions Scenarios Committee was formed to provide a forum for meeting the combined needs of the atmospheric science community, the aircraft industry, NASA and the federal government in undertaking the development of scenarios for such assessments.

18732 (VTT-SYMP-120) **Underwater technology symposium.** Technical Research Centre of Finland, Espoo (Finland). 1991. 149p. (CONF-9011286-: Seminar on underwater technology, Tampere (Finland), 1 Nov 1990). Order Number DE92506505. Source: OSTI; NTIS (US Sales Only).

In this survey underwater energy source possibilities are treated. The power demand of underwater vehicles is restricted to approximately 0.5 MW. Besides well-known primary and secondary batteries as well as conventional diesel engines and closed cycle diesels, fuel cells, radio nuclear isotopes and small nuclear reactors have already now been installed or tested in conditions representative of underwater.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 17809, 17861, 17888, 18146, 18147, 18148, 18155, 18158, 18166, 18167, 18179, 18180, 18183, 18204, 18271, 18589, 18603, 18604, 18605, 18662, 18697, 18765, 18769, 18777, 19009, 19026, 19047, 19115, 19122, 19448, 19459, 20595

18733 (AECL-10030) **Selective removal of dissolved toxic metals from groundwater by ultrafiltration in combination with chemical treatment.** Buckley, L.P. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Le, V.T.; McConeghy, G.J.; Martin, J.F. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1989. 17p. (CONF-8909470-: HAZTECH international '89 conference, Cincinnati, OH (United States), 12-14 Sep 1989). Order Number DE92627038. Source: OSTI; NTIS (US Sales Only); INIS.

An alternative in-place process for the removal of toxic heavy metals based on aqueous solution chemistry and treatment is being evaluated under the auspices of the Emerging Technologies Program funded through the USEPA's Superfund Innovative Technology Evaluation Program. The technique involves the contacting of aqueous solutions containing the heavy metal contaminants with low concentrations of polyelectrolytes, and then removing the polyelectrolytes from solution with ultrafiltration membranes. The first phase of the program is considered complete. Success has been achieved for the separation of soluble, heavy metal ions: cadmium, lead, and mercury even in the presence of an organic compound, toluene. Removal was successful at alkaline conditions, using any combination of membrane material or polyelectrolyte. Arsenic was removed, but not effectively, using the current polyelectrolytes, simply because arsenic is present as an anionic species rather than as a cationic species. Optimization of the process variables is nearing completion and pilot and field testing will take place in the second year of the program to verify the process under realistic conditions and to establish process economics.

18734 (AFME-90-11-1) **Heat exchangers and heat recovery.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 158p. (In French). Order Number DE92792641. Source: OSTI; NTIS (US Sales Only).

Various studies concerning heat exchangers are presented: characterization of battery fins, a test bench for qualification of industrial heat exchangers, regenerative burners for aluminum melting furnace, a silicon carbide made recuperator for self-recuperating burners, thermohydraulics and dimensioning of plate exchangers, condensative heat recovery systems, heat pipes working with water modelization of heat transfer.

18735 (AFME-90-11-2) **Efficient management of raw materials: a new challenge for energy and the environment.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 128p. (In French). Order Number DE92792639. Source: OSTI; NTIS (US Sales Only).

Various examples concerning raw materials and wastes management are presented: industrial and economic aspects of raw material recycling, treatment process for container steels, recycling of aluminum scraps and wastes (refining), solvent refining in a container aluminum sheet varnishing and printing plant, intelligent plastic processing and reduction of raw material consumption, methane production and pyrolysis processes for waste upgrading, municipal and industrial waste incineration.

18736 (CONF-9001171-) **Potential and assessment of alternative energy conversion processes. Sub-project B: Energy conversion processes - potential and assessment. Proceedings.** Daimler-Benz-AG - Forschung und Technik. Schnieder, H. (ed.). Daimler-Benz AG, Berlin (Germany). Forschung Technikumfeld. Feb 1991 125p. (In German). From Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990. Order Number DE92515841. Source: OSTI; NTIS (US Sales Only).

For the reduction of environmental impact caused by the present energy supply system, numerous and different measures are necessary. From the technical-physical point of view and in view of environmental aspects, the following measures seem to be especially promising and urgent: (1) Energy integration (process and structure optimization) (process directed technology, control technology), (2) Solar-thermal systems ambient heat, industrial water, (3) Distric heating systems (hot tap water storage systems), (4) Coupling systems for production of power, heat and cooling. Among the ecological harmless energy conversion systems, which are not available commercially at present, the following processes offer important fields of research and development: (1) Waste heat power systems (new organic working materials), (2) Passive solar energy utilization (transparent insulation), (3) Activated heat pipes and thermosiphons, (4) heating fuel cells. (orig.).

18737 (CONF-9001171–, pp. 65-84) **Advanced absorption technology for energy conservation and pollution control.** Alefeld, G. (Technische Univ. Muenchen (Germany). Physic Dept. E 19). Daimler-Benz AG, Berlin (Germany). Forschung Technikumfeld. Feb 1991. 125p. (In German). From Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990. In *Potential and assessment of alternative energy conversion processes. Sub-project B: Energy conversion processes - potential and assessment. Proceedings.* Order Number DE92515841. Source: OSTI; NTIS (US Sales Only).

The refrigeration industry is confronted with the biggest technical change of its history within a period of less than one decade. Efficient energy utilization is the most important sector for the reduction of the greenhouse effect and for the protection of resources. Progressive absorption technology can contribute considerably to the reduction of the above problems by: (a) partial substitution of fluorine chlorine hydrogen technology by absorption technology in the field of refrigeration, air conditioning and heat pumps, (b) energy saving in connection with existing or new supply systems, (c) direct application of the absorption technology in the field of environmental protection for example for water purification, flue gas purification etc. The following presentation is concentrated on the important item (b). After presentation of the energy saving potential in the area of cogeneration, progressive systems are explained and are finally discussed with regard to applications, also for item (a) and (c). (orig./UA).

18738 (CONF-9110375–) **Proceedings of the 2nd annual conference of the Japan society of waste management experts.** Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This proceedings contain 119 papers published in the 2nd Annual Conference of the Japan Society of Waste Management Experts held in Oct 1991. The papers are classified into hazardous materials in seepage water, incineration plans, disposal of flue gas/ash residue after incineration such as waste generation/weight reduction, fundamental plans for waste disposal/resident participation, treatment of human waste/sewage sludge, compost/waste retrieval by utilization of microorganism, collection/transport, recycling/waste retrieval, economic evaluation, disposal of industrial waste/hazardous materials, decomposition of reclaimed site waste/characteristics of seepage water, inorganic salt in seepage water, reclamation plans/utilization of unused land. In the conference, there was a symposium, where reports and discussions were made under a title of 'Basic technology for control of dioxin emission in waste incineration and future subjects'. Among these papers, attention should be paid on those having themes regarding waste collection/transport system, economic evaluation of a waste disposal cost and waste incineration plans.

18739 (CRIE-W–91002) **Development of advanced heat pump for hot tap-water supply.: Evaluation of energy and economic efficiency of the system.** Saikawa, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Iwatsubo, T.; Hasegawa, H.; Hamamatsu, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jul 1991. 27p. (In Japanese). Order Number DE92514550. Source: OSTI; NTIS (US Sales Only).

Central Research Institute of Electric Power Industry (CRIEPI) has been developing a two-stage compression type hot-water supply heat pump for commercial use, aiming at energy saving in the hot-water supply field. This paper makes an evaluation of energy saving and economic efficiency of this heat pump in case of applying the system to four types of buildings which are different in heat load structure. Results obtained are as follows: CRIEPI's system is so energy-saving and approximately 20-30% lower in primary energy consumption than the conventional one. CO_2 emissions calculated using CO_2 emission unit requirement of each energy are approximately 30-40% lower than those of the conventional one, and this system is so superior in environmental conservation. If estimating depreciation period of the system at 15 years, the system is low in annual running cost and can be competitive in economic efficiency. Particularly in a building which is large in hot-water supply load and larger in cooling load than in heating load, the system has an advantage in economic efficiency. This is because CRIEPI's two-stage compression type heat pump can make cold water for cooling during a supply of hot water and therefore installation capacity of the airconditioning heat pump can be decreased. 3 refs., 4 figs., 17 tabs.

18740 (DOE/CH/10461–1) **Energy aspects of solid waste management: Proceedings.** Illinois Univ., Chicago, IL (United States). Energy Resources Center. [1990]. 193p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States); Environmental Protection Agency, Washington, DC (United States). DOE Contract FG02-90CH10461. (CONF-9010176–: 18. annual Illinois energy conference energy aspects of solid waste management, Chicago, IL (United States), 29-30 Oct 1990). Order Number DE92011005. Source: OSTI; NTIS; GPO Dep.

The Eighteenth Annual Illinois Energy Conference entitled "Energy Aspects of Solid Waste Management" was held in Chicago, Illinois on October 29–30, 1990. The conference program was developed by a planning committee that drew upon Illinois energy and environmental specialists from the major sectors including energy industries, environmental organizations, research universities, utility companies, federal, state and local government agencies, and public interest groups. Within this framework, the committee identified a number of key topic areas surrounding solid waste management in Illinois which were the focus of the conference. These issues included: review of the main components of the solid waste cycle in the Midwest and what the relative impact of waste reduction, recycling, incineration and land disposal might be on Illinois' and the Midwest's solid waste management program. Investigation of special programs in the Midwest dealing with sewage sludge, combustion residuals and medical/infectious wastes. Review of the status of existing landfills in Illinois and the Midwest and an examination of the current plans for siting of new land disposal systems. Review of the status of incinerators and waste-to-energy systems in Illinois and the Midwest, as well as an update on activities to maximize methane production from landfills in the Midwest.

18741 (DOE/ER/13318–T1) **Multivariable and distributed control of nonlinear chemical processes using adaptive methods: Final report, February 1, 1985–January 31, 1988.** Ydstie, B.E. Massachusetts Univ., Amherst, MA (United States). Goessmann Lab. [1988]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13318. Order Number DE92011576. Source: OSTI; NTIS; GPO Dep.

In this work we studied the application of adaptive learning and optimization to chemical process control. The work covered theory as well as practical applications of adaptive and nonlinear control, including multivariable periodic control The main findings were: 1. Linear adaptive control systems may display chaotic behavior. The chaos has small amplitude if the algorithm is properly implemented. 2. Stability theory for nonlinear adaptive control has been developed. 3. Experimental evaluation of predictive control was performed. 4. A theory for periodic control and adaptive periodic control of chemical processes was developed.

18742 (EGG-EP–9918) **Feasibility studies for the Sonic Sensor System for noninvasive temperature measurement in the food processing industry.** Beller, L.S.; Mikesell, C.R.; Taylor, S.C.; Tow, D.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012317. Source: OSTI; NTIS; GPO Dep.

Feasibility studies for development of the Sonic Sensor System to measure temperature in the interior of particulates during food processing are described. The method involves tomography-based acquisition and interpretation of speed of sound data. The method is found to be feasible, and representative engineering problems and other technical issues are identified. A two-step approach to concept commercialization, involving replacement of the present puncture-and-thermometer method is conventional batch processing and development of a device to use in continuous aseptic processing, is proposed. A conservative estimate of immediate energy savings, just for food processing, is 0.01 quad/y. Potential follow-on applications are discussed.

18743 (EGG-M–91551) **Silicon smelting in a closed furnace.** Dosaj, V. (Dow Corning Corp., Midland, MI (United States)); Brumels, M.D.; Haines, C.M.; May, J.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9111206–1: 1991 electric arc furnace conference, Toronto (Canada), 13 Nov 1991). Order Number DE92011157. Source: OSTI; NTIS; GPO Dep.

Dow Corning has been working towards the advancement of silicon smelting in a closed furnace over the past four years. A 200 kVA closed furnace pilot plant unit was built to investigate the operating parameters for smelting silicon. The single electrode furnace is operated under totally sealed conditions. The feed from the feed hoppers is fed through air locks to the furnace. The off-gas from the furnace, consisting of by-product CO as well as volatiles from the feeds, pass through a venturi scrubber, where water is introduced to scrub out the fume from the furnace and cool the gas. The mixed scrubber water and off-gas pass into a centrifugal mist eliminator where the water and fume disengage from the gas. The fume slurry is passed through bag filters where the fume is separated from the water. The clean off-gas from the furnace was evaluated for its calorific value and evaluated for conversion to useful products. A number of silicon smelting tests were conducted during this program. Various levels of charcoal and coal mixtures were evaluated to determine the optimum mix. A low volatile coal was preferred over typical Blue Gem coal. The coal amount in the mix was maximized without compromising the smelting performance. A raw material mix consisting of 30% charcoal and 70% low volatile coal was determined to be an optimum mix for closed furnace operation. Silicon recoveries in the low nineties were demonstrated using this mix. Four quartz sources were also evaluated in the closed furnace. The closed furnace operation for silicon smelting was identified to offer significant advantages over an open furnace from the standpoint of reduced carbon oxidation losses, electrode consumption, electrical energy consumption and silicon yield improvement. Other advantages in addition to process off-gas recovery included improved safety from reduced heat and fume exposure, and improved pollution control to the environment. 1 ref.

18744 (ENEA-RTI-STUDI-ENE–91-03) **Increased Italian maritime transport alternative to road transport: Feasibility relative to normatives, technology, socio-economics and environment.** Tommaso, G.; Chironi, T. ENEA, Rome (Italy). Direzione Studi. Nov 1991. 216p. (In Italian). (RTI-STUDI-ENE–91-03). Order Number DE92506234. Source: OSTI; NTIS (US Sales Only).

This paper examines the technological, socio-economic and environmental feasibility of a proposal to strengthen the Italian commercial coastal shipping system as an alternative to bolstering existing road transport facilities in order to meet the requirements of increased trade in the new European free market. This prospect is of special importance to Italy due to its long coastlines. The principal elements taken into account are: investment capital, labour and energy requirements. The study first examines the supply and demand dynamics of the European transport system. Here, attention is given to energy consumption. This examination is followed by a review of the European situation with regard to normatives governing navigation and customs duties. Road, rail and maritime transport costs are compared, and an assessment is made of the economic feasibility of an integrated-means system of transport involving the coordinated use of special containers, tractor-trailers and interchangeable railway cars/truck trailers. Environmental benefits, in terms of reduced pollution caused by road transport, to be had through the increasing of maritime traffic, are also evaluated. A look is give at the organizational nature of the Italian maritime transport system and the reforms that would have to be made to the existing structure in order to make any future expansion of maritime traffic a viable venture.

18745 (ENET–8900016-1) **Development of a thermal heat pump with Stirling engine and resonance tube.** Budlinger, J.P. (TELMECO S.A., Plan-les-Quates (CH)). Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Apr 1991. 96p. (In German, French). EF-PROC (88) 17. Order Number DE92515357. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

As part of an NEFF order the development of a thermal heat pump with a Stirling drive and a resonance tube is examined. In this report experiments are described which allow a decision to be made on the best variants of the system. The aim was to record the experimental and theoretical relationships between the flow, heat transfer and the mechanics of the system without tending towards a high capacity figure. The trial system built in the first stage only comprised the Stirling motor section and the resonance tube without the actual heat pump section. The test results can be compared with the theoretical results produced from a simulation model. Parallel to this experimental study a complete heat pump system was optimised to allow a better estimate of the possible capacity figures of the overall system to be made. This theoretical work resulted in other possible ways of improving the basic principle. figs., tabs., 15 refs.

18746 (ETDE-mf–92515847) **Reduction of the demand for water and energy when applying mobile irrigation systems.** Landbauforschung Voelkenrode. Wissenschaftliche Mitteilungen der Bundesanstalt fuer Landwirtschaft Braunschweig-Voelkenrode. Sonderheft. Sourell, H. Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany); Hannover Univ. (Germany). Fachbereich Gartenbau. 1991 135p. (In German). Order Number DE92515847. Source: OSTI; NTIS (US Sales Only).

The goal of this work was to show the possibilities of reducing the demand for water and energy when applying mobile irrigation systems. With this, two problems appeared: 1. possiblities of keeping the irrigation height alongside the irrigation line constant, 2. possibilities of improving the water distribution at right angles to the irrigation line. Calculations show that 7,5% less water have to be supplied and distributed if an overage irrigation height of 30 mm is assumed. For the improvement of the water distribution alongside the irrigation line, a new distribution system has been developed. As a conclusion, energy demand, capital demand and cost of the method are determined on condition that an electronic feed speed control system and the jet machine are used at the same time. (BWI).

18747 (HWS–8584) **Construction specification for Animal Waste Treatment Facility, 331 Building Complex, Project BAP-060.** Cornell, Howland, Hayes and Merryfield, Inc., Bellevue, WA (United States). [1973]. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011855. Source: OSTI; NTIS; GPO Dep.

This paper outlines the specifications for the construction of an animal waste treatment facility. It includes: (1) earthwork and belowground structures, (2) reinforced concrete, (3) fabricated metalwork, (4) field painting, (5) metal building, (6) sludge dryer, (7) package treatment plant, (8) miscellaneous pumps, (9) plumbing and miscellaneous mechanical equipment, (10) ventilation equipment, and (11) electrical.

18748 (IS-T–1555) **Encapsulation of hazardous wastes into agglomerates.** Guloy, A. Ames Lab., IA (United States). 28 Jan 1992. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012585. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this study was to investigate the feasibility of using the cementitious properties and agglomeration characteristics of coal conversion byproducts to encapsulate and immobilize hazardous waste materials. The intention was to establish an economical way of co-utilization and co-disposal of wastes. In addition, it may aid in the eradication of air pollution problems associated with the fine-powdery nature of fly ash. Encapsulation into agglomerates is a novel approach of treating toxic waste. Although encapsulation itself is not a new concept, existing methods employ high-cost resins that render them economically unfeasible. In this investigation, the toxic waste was contained in a concrete-like matrix whereby fly ash and other cementitious waste materials were utilized. The method incorporates the principles of solidification, stabilization and agglomeration. Another aspect of the study is the evaluation of the agglomeration as possible lightweight aggregates. Since fly ash is commercially used as an aggregate, it would be interesting to study the effect of incorporating toxic wastes in the strength development of the granules. In the investigation, the fly ash self-cementation process was applied to electroplating sludges as the toxic waste. The process hoped to provide a basis for delisting of the waste as hazardous and, thereby greatly minimize the cost of its disposal. Owing to the stringent regulatory requirements for hauling and disposal of hazardous waste, the cost of disposal is significant. The current practice for disposal is solidifying the waste with portland cement and dumping the hardened material in the landfill where the cost varies between $700–950/ton. Partially replacing portland cement with fly ash in concrete has proven beneficial, therefore applying the same principles in the treatment of toxic waste looked very promising.

18749 (KCP–613–4505) **Computer-aided modeling of axisymmetric die forging: Progress report 1.** El-Gizawy, A.S. (Missouri Univ., Columbia, MO (United States). Dept. of Mechanical and Aerospace Engineering). Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div.; Missouri Univ., Columbia, MO (United States). Dept. of Mechanical and Aerospace Engineering. Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012108. Source: OSTI; NTIS; GPO Dep.

A computer process model provides a mathematically approximate description of the physical process of metal deformation. The most commonly used approximation method is the "slab method." The slab method considers the stresses on a plane perpendicular to the direction of metal flow. When the forces on the slab are set at static equilibrium, the condition can be represented by a differential equation. By analytical or numerical integration of the differential equation, with appropriate boundary conditions, it is possible to calculate the forging forces. Application of the slab method to axisymmetric fie forging was divided into two stages: axisymmetric upsetting of the billet between dies; and radial flow to flash which starts after filling the die cavity. The modeling program was written in Fortran and integrated with computer graphics software FIGARO by MEGATEK.

18750 (KTM/E-B–99) **SULA Energy-efficient steel and metal production: Interim report 1988-1990.** Hakulin, H. (Association of Finnish Steel and Metal Producers, Helsinki (Finland)). Ministry of Trade and Industry, Helsinki (Finland). Energy Dept. 1991. 64p. Project KTM-367/881/87. Order Number DE92506483. Source: OSTI; NTIS (US Sales Only).

Finland's energy research programmes. Published also in Finnish Report no B:98.

The aim of the SULA programme is to improve energy efficiency in steel and base metal production. The practical objectives are: lower specific energy consumption in production processes, development of new, more energy efficient processes and more flexible use of different forms of energy. The common objective in all research and joint development projects is to decrease the direct energy consumption of production processes. In the programme, following processes are objects of research: production of molten iron and steel from iron ore, production of molten special and stainless steel from scrap and ferroalloys, production of ferrochromium, production of electrolytic copper, granules, pyrometallurgical production of zinc, strip casting of steel and rolling of steel. R and D efforts are also directed to the application of knowledge-based technology, continuous tempemture measurement of molten mess, and heating furnace linings. For the main part of the projects, this intermediate report deals with the first 18-19 months of the resarch work. The time span of the objectives varies from 1 to about 20 years. In some projects, substantial energy savings are already achieved. The long-range aim is to lower the specific energy consumption of fuels by 15 % and that of electric energy by 30 %.

18751 (NEI-DK–810) **The Elgaard project: Elsam research and development project. Half-way report.** Statens Jordbrugstekniske Forsoeg, Horsens (Denmark). Aug 1991 127p. (In Danish). Order Number DE92506342. Source: OSTI; NTIS (US Sales Only).

In coorporation with "De 13" elselskaber.

The aim of the project was to discover methods for achieving energy conservation in relation to farming. The method was to send out questionaires, to carry out measurements, energy analyses and tests, and to collect information on the subject - in Denmark. It was found important to clarify whether there is any connection between electricity consumption and the forms of farm production. The average electricity consumption for farms with crop, pig, milk, mixed farming and poultry production was found to be 79,000, 91,000, 68,000, 86,000 and 133,000 kWh annually, respectively. There seemed to be a proportional relationship between electricity consumption and the total area of fields, and with the size and character of herds owned by the farms. Danish farmers were generally positive about investing money in energy conservation. 64% of them accepted a pay-back period of 5 years, the remainder wished for a shorter term. 50% of the the farmers expected an increase of 5% in electricity consumption within the next 5 years. It was concluded that potentials for savings lay within the areas of ventilation (25-60%, pig and poultry), heating (15-33%, barns for piglets), lighting (15-35%, barns for cows and sows), milk cooling (15-20%) and corn drying, (15-40%, larger field areas). (AB).

18752 (NEI-NO–199) **Decision support for the production of 75% FeSi.** Heimdal, S.I. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Apr 1991 256p. (In Norwegian). Order Number DE92506525. Source: OSTI; NTIS (US Sales Only).

This thesis is a contribution to the subject of applied economic analysis, and it is written with an operational research and decision support system's perspective. The thesis focuses on the economics of ferrosilicon (FeSi) production and its scope is limited to tactical issues for a plant operating up to two furnaces. The first part of this text is concerned with technical issues. It presents results from empirical analyses of silicon yield and specific energy consumption. The silicon yield is surprisingly stable over time when furnace operation is adjusted for accumulation and "melt outs" of silicon. This knowledge is used when modeling and estimating functional expressions of the specific energy consumption. The parameters estimated will be the constant energy loss and energy losses proportional with the electric load at normal electric load levels. The second part of the thesis presents different models for economic evaluation of furnace operation. Several furnaces are combined with costs and losses after tapping and limited amounts of low-cost energy in models which may be used to calculate how to run the furnaces optimally at different FeSi price levels. The final part focuses on the furnace exit and entry decisions. The cost of stopping and starting a furnace are high, and a volatile FeSi price will give exit and entry price levels which are different from price levels calculated by pure deterministic models. The theoretical foundation for this part are contingent claims analysis and stochastic optimal control theory. 44 figs., 45 tabs., 50 refs.

18753 (NEI-NO–201) **Dynamic optimization in state-space predictive control schemes.** Strand, S. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1991 289p. Order Number DE92506527. Source: OSTI; NTIS (US Sales Only).

Optimization is a useful and in many cases necessary tool to increase the profit rates from an industrial process. This will often lead to process operation at the intersection of constraints. A multivariable controller which has a flexible structure and explicitly accounts for the constraints is needed for the realization of such operation points. Only the model-predictive controllers have succeeded in this task, and such schemes have been developed and implemented during the last two decades. In the presentation of proven model predictive control (MPC), most emphasis is given to the Dynamic Matrix Control (DMC) developed by the Shell Oil Company during the seventies. All the known implementations of MPC make use of a linear input-output model and quadratic control objectives. The appealing consequences are that the resulting quadratic program can be solved at an acceptable speed by modest computing power, and that the model can be established experimentally. Constraints on manipulated and measured variables are explicitly accounted for. The State-Space Predictive Control (SSPC) scheme which is proposed in this thesis offers certain advantages to the earlier MPC-techniques, at the cost if increased modeling efforts and computational loads. The generally nonlinear statespace model is favorable to a linear description when the nonlinearities in the process dynamics are severe in the actual operating region. This mean that the advantage of the nonlinear model will be pronounced when the operating points are frequently changing. 32 figs., 18 tabs., 92 refs.

18754 (NUTEK–90-4054) **Preliminary study on gasification of black liquors.** Warnqvist, B. (AaF-IPK AB, Stockholm (Sweden)). NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 29 Oct 1991. 24p. (In Swedish). Order Number DE92506604. Source: OSTI; NTIS (US Sales Only).

The report describes processes for gasification of black liquors and their effects on the processes of the pulping plant, possibilities for increased power generation and the information needs. A coordinated program for Swedish R and D in the field is called for, and information exchange with North America and Finland should be considered.

18755 (NUTEK–91-702) **Effects of heavy black liquor gasification on chemicals balance and pulp production.** Ulmgren, P. (STFI, Stockholm (Sweden)); Lindstroem, R. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 31 Oct 1991. 26p. (In Swedish). Order Number DE92506605. Source: OSTI; NTIS (US Sales Only).

The consequences of a change to gasification of spent liquors for a sulfate pulping mill are investigated, and the need for knowledge and technology development in certain areas are focused. Most important advantages with gasification are: Reduced risks for melt-water explosions, increased power generation, capacity increase (complement to the soda recovery boiler), and - for soda processes, production of sulfide-free soda, and production of green liquor with different sulfide concentrations. More knowledge is needed concerning: advantages in a modified sulfate process with liquors of varying sulfide concentrations, absorption of hydrogen sulfide in liquor under pressure, kinetics for causticising solutions with high concentrations of hydrogen carbonate ions, and differences between soda recovery boiler processes and gasification on occurrence of process-foreign elements.

18756 (PNL–7919) **Impact evaluation of an Energy Savings Plan project at Columbia Harbor Lumber Company.** Spanner, G.E.; Sullivan, G.P. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011505. Source: OSTI; NTIS; GPO Dep.

This impact evaluation of an energy conservation measure (ECM) that was recently installed at Columbia Harbor Lumber Company (Columbia Harbor Lumber), Chehalis, Washington, was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy Savings Plan (ESP) Program. The Program makes acquisition payments to firms that install energy conservation measures in their industrial processes. The objective of this impact evaluation was to assess how much electrical energy is being saved at Columbia Harbor Lumber as a result of the ESP and to determine how much the savings cost Bonneville and the region. The impact of the ECM was evaluated with a combination of engineering analysis, financial analysis, interviews, and submittal reviews (Columbia Harbor Lumber's Completion Report and Proposal). The ECM itself consists of an adjustable speed drive for controlling the speed of nine fans on a lumber drying kiln. Energy savings resulting from this ECM are expected to be 286,500 kWh/yr. On a per unit of output basis, this ECM will save 0.053 kWh/board foot, a 48% reduction. The ECM cost $24,086 to install, and Columbia Harbor Lumber received payment of $19,269 from Bonneville for the acquisition of energy savings. In all likelihood, this ECM would have been installed even without the acquisition payment from Bonneville. The levelized cost of these energy savings to Bonneville will be 5.6 mills/kWh over the ECM's expected 15-year life, and the levelized cost to the region will be 7.4 mills/kWh.

18757 (PNL–7920) **Impact evaluation of an Energy Savings Plan project at Lenroc Company/Moorman Manufacturing.** Spanner, G.E.; Daellenbach, K.K. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011504. Source: OSTI; NTIS; GPO Dep.

This impact evaluation of an energy conservation measure (ECM) that was recently installed at Lenroc Company/Moorman Manufacturing (Lenroc/Moorman) was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy Savings Plan (ESP) Program. The Program makes acquisition payments to firms that install energy conservation measures in their industrial processes. The objective of this impact evaluation was to assess how much electrical energy is being saved at Lenroc/Moorman as a result of the ESP and to determine how much the savings cost Bonneville and the region. The impact of the ECM was evaluated with a combination of engineering analysis, financial analysis, interviews, and submittal reviews (Lenroc/Moorman's Abstract, Proposal, and Completion Report). The ECM itself consists of installing two heat exchangers to recover waste heat from a process water line to preheat incoming process air. The air and water are used in a proprietary process to produce biuret, a cattle feed supplement derived from urea. Energy savings resulting from this ECM are expected to be 339,400 kWh/yr. On a per ton basis, this ECM will save 56.6 kWh/ton of biuret. The ECM cost $15,754 to install, and Lenroc/Moorman received payments of $9452 from Bonneville and $3933 from Grant County PUD for the acquisition of energy savings for a net cost to Lenroc/Moorman of $2369. Without the acquisition payments from Bonneville and Grant County PUD, this ECM would not have been implemented. The levelized cost of these energy savings to Bonneville will be 2.3 mills/kWh over the ECM's expected 15-year life, and the levelized cost to the region will be 4.0 mills/kWh.

18758 (PNL–8076) **Final report on DSA methods for monitoring alumina in aluminum reduction cells with cermet anodes: Inert Electrodes Program.** Windisch, C.F. Jr. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013599. Source: OSTI; NTIS; GPO Dep.

The Sensors Development Program was conducted at the Pacific Northwest Laboratory (PNL) for the US Department of Energy, Office of Industrial Processes. The work was performed in conjunction with the Inert Electrodes Program at PNL. The objective of the Sensors Development Program in FY 1990 through FY 1992 was to determine whether methods based on digital signal analysis (DSA) could be used to measure alumina concentration in aluminum reduction cells. Specifically, this work was performed to determine whether useful correlations exist between alumina concentration and various DSA-derived quantification parameters, calculated for current and voltage signals from laboratory and field aluminum reduction cells. If appropriate correlations could be found, then the quantification parameters might be used to monitor and, consequently, help control the alumina concentration in commercial reduction cells. The control of alumina concentration is especially important for cermet anodes, which have exhibited instability and excessive wear at alumina concentrations removed from saturation.

18759 (SAND–92-0520C) **Lessons from Archimedes, a system for planning and executing mechanical assemblies.** Strip, D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920540–16: 1992 Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics and automation, Nice (France), 10-15 May 1992). Order Number DE92010957. Source: OSTI; NTIS; GPO Dep.

Archimedes is a prototype mechanical assembly system which generates and executes robot assembly programs from a CAD model input. The system seeks to increase flexibility in robotic mechanical assembly applications by automating the programming task. Input is a solid model of the finished assembly, augmented by additional design information such as weld specifications. Parts relationships and geometric constraints are deduced from the solid model. A rule-based planner generates a "generic" assembly plan that satisfies the geometric constraints, as well as other constraints embodied in the rules. A plan compiler then converts the generic plan into code specific to an application environment. Other outputs include fixture designs, workcell layout information, object-recognition (vision) routines, grasp plans, and executable code for controlling the robot and workcell accessories. Lessons from operating and demonstrating the system are presented, with a particular emphasis on the implications for future systems. 12 refs.

18760 (TKK-V–C110) **Process of ferrochromium now and in the future.** Kojo, M.; Holappa, L. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Metallurgy. 1991. 52p. (In Finnish). Order Number DE92506510. Source: OSTI; NTIS (US Sales Only).

The most essential objectives in the development of the ferrochromium process are the reduction of energy consumption and improvements in the recovery of chromium. For measuring the activity of chromium oxide in slags, there was developed a measuring system based on an oxygen-ion conductive solid electrolyte. Owing to the high temperature and aggressive nature of the slags, there were difficulties in the measurements as for the life of cell and crucible materials. Progress was made by developing the technique, and measurements were carried out for the basic slag system CaO- SiO_2- Cr_xO, as well as for individual 4-component slags, and reproducible results were obtained.

18761 (VTT-SYMP–122) **Bioconversion of plant raw materials - biotechnology advancement: Finnish-Soviet Seminar.** Niku-Paavola, M.L. (ed.). Technical Research Centre of Finland, Espoo (Finland). 1991. 243p. (CONF-9003318–: Seminar on bioconversion of plant raw materials - biotechnology advancement, Mustio (Finland), 14-16 Mar 1990). Order Number DE92506504. Source: OSTI; NTIS (US Sales Only).

The proceedings of the seventh Finnish-Soviet seminar on 'Bioconversion of plant raw materials' are presented as seventeen papers.These papers concern technological, biochemical and microbiological aspects of the bioconversion of lignocellulosic materials. The properties of the microbes and enzymes involved are described. Enzymatic pretreatments for food and feed materials are introduced. Biotechnical applications for the pulp and paper industry are presented. Techniques in mushroom cultivation are reported.

18762 (VTT-TIED–1292) **Requirements engineering in process automation: Approach methods for preliminary and basic design.** Tommila, T. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering); Viitamaeki, P. Technical Research Centre of Finland, Espoo (Finland). Oct 1991. 119p. (In Finnish). Order Number DE92506486. Source: OSTI; NTIS (US Sales Only).

The early stages of design are found to be critical for successful utilization of information technology. This research report discusses requirements engineering in process automation. The requirements specification phase includes preliminary design and the first subtasks of basic design. The result of this phase, the requirements model, is the high level description of the properties and functions of the control system, and based on this, the selection of system vendor. The information contents of the requirements model is defined on the basis of cent practices and the design principles used in software engineering. In addition to this, a general design procedure and a checklist for requirements specification in process automation are given.

18763 (VTT-TUTK–704) **Knowledge based approach to support Hazop-studies.** Karvonen, I. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering). Technical Research Centre of Finland, Espoo (Finland). Aug 1990. 66p. Order Number DE92506487. Source: OSTI; NTIS (US Sales Only).

The report describes a study carried out in the Technical Research Centre of Finland to develop an expert system to support safety analysis of process systems, especially Hazard and Operability Study. A flexible tool could contribute to the application of Hazop in early phase of process design and thus increase system safety. The outcome of the project is a prototype called HAZOPEX, which includes extensive knowledge about potential causes of deviations, less knowledge about consequences or measures, but still has weaknesses of a research prototype with the user interface. HAZOPEX makes use of the process structure described to the system as linkages between process components. The functions of the prototype as well as the new method to race potential causes of disturbances from the structure are described in the report. The prototype has been applied in two small cases with partners outside the project group and the results of the experiments are reported. A summary of the development needs is presented and a specification of an advanced version of HAZOPEX is given in the appendix.

18764 (VTT-TUTK–737) **Scenarios for consumption of energy, emissions, and the structure of production in forest industries.** Tamminen, E. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering); Forsstroem, J. Technical Research Centre of Finland, Espoo (Finland). Aug 1991. 88p. (In Finnish). Order Number DE92506488. Source: OSTI; NTIS (US Sales Only).

The project is financed by the Finnish Ministry of Trade and Industry.

The possibilities to reduce consumption of energy or emissions of carbon dioxide, sulphur dioxide, and of nitrogen oxides through structural changes in Finnish wood processing industries have been studied in this work. We consider six scenario variables: total consumption of electricity, purchases of electricity, consumption of market fuels, and emissions of CO_2, SO_2, and NO_2 (all emissions of different nitrogen oxides have been computed as an equivalent amount of NO_2). For each scenario variable we have analyzed structural changes in production and in energy economy which reduce the value of the variable. The costs of reducing the scenario variable are also computed. Further the influence of a rising cost of electricity on the structure of production and on energy economy is studied. As the main result we present a detailed, quantitative picture of possibilities for structural adjustment to reduced energy use and to reduced emissions. In the cases studied these possibilities are not very extensive. However, this result is based on a very cautious market forecast and on the present level of technology. New market opportunities, and new products and processes open also new possibilities to reduce emissions and energy use through changes in the structure of production.

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Refer also to citation(s) 18191, 18192, 18198, 18275, 18276, 18355, 18578, 18587, 18588, 18604, 18605, 18606, 18696, 18735, 18738, 18740, 19122, 19393, 19425

18765 (AFME–90-11-3) **Cogeneration of heat and mechanical energy.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 62p. (In French). Order Number DE92792642. Source: OSTI; NTIS (US Sales Only).

The main topics of this meeting are: cogeneration development and prospectives in Spanish industry and in China, small gas turbine cogeneration, natural gas cogeneration development prospectives in France, cogeneration with a heavy gas oil generating set.

18766 (ANL–92/5) **Detection and location of leaks in district heating steam systems: Survey and review of current technology and practices.** Kupperman, D.S.; Raptis, A.C.; Lanham, R.N. Argonne National Lab., IL (United States). Mar 1992. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013740. Source: OSTI; NTIS; GPO Dep.

This report presents the results of a survey undertaken to identify and characterize current practices for detecting and locating leaks in district heating systems, particular steam systems. Currently used technology and practices are reviewed. In addition, the survey was used to gather information that may be important for the application of acoustic leak detection. A few examples of attempts to locate leaks in steam and hot water pipes by correlation of acoustic signals generated by the leaks are also discussed.

18767 (ANL/CP–75733) **Landfill CH_4: Rates, fates, and role in global carbon cycle.** Bogner, J.; Spokas, K. Argonne National Lab., IL (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9110220–2: North Atlantic Treaty Organization (NATO) advanced research workshop, Mount Hood, OR (United States), 6-11 Oct 1991). Order Number DE92010906. Source: OSTI; NTIS; GPO Dep.

Published estimates for worldwide landfill methane emissions range from 9 to 70 Tg yr^{-1}. Field and laboratory studies suggest that maximum methane yields from lanfilled refuse are about 0.06 to 0.09 m^3 (dry Kg)$^{-1}$ refuse, depending on moisture content and other variables, such as organic loading, buffering capacity, and nutrients in landfill microevnironments. Methane yields may vary by more than an order of magnitude within a given site. Fates for landfill methane include (1) direct or delayed emission to the atmosphere through landfill cover materials or surface soils; (2) oxidation by methanotrophs in cover soils, with resulting emission of carbon dioxide; or (3) recovery of methane followed by combustion to produce carbon dioxide. The percent methane assigned to each pathway will vary among field sites and, for individual sites, through time. Nevertheless, a general framework for a landfill methane balance can be developed by consideration of landfill age, engineering and management practices, cover soil characteristics, and water balance. Direct measurements of landfill methane emissions are sparse, with rates between 10^{-6} and 10^{-8} g cm^{-2} s^{-1}; very high rates of 400 kg m^{-2} yr^{-1} have been measured at a semiarid unvegetated site. The proportion of landfill carbon that is ultimately converted to methane and carbon dioxide is problematical; the literature suggests that, at best, 25% to 40% of refuse carbon can be converted to biogas carbon. Cellulose contributes the major portion of the methane potential. Routine excavation of nondecomposed cellulosic materials after one or two decades of landfill burial suggests that uniformly high conversion rates are rarely attained at field sites.

18768 (BFR-R–6-92) **Electricity substitution: Going from electric heating to district heating in houses with water based heating systems.** Plogner, H. (Jaemtkraft AB, Oestersund (Sweden)); Strandell, T.; Stillesjoe, S. Swedish Council for Building Research, Stockholm (Sweden). 1992. 69p. (In Swedish). Project BFR-880720-9. Order Number DE92506622. Source: OSTI; NTIS (US Sales Only).

Three different residential areas in the city of Oestersund were studied in order to judge the possibilities to substitute electric heating in one-family houses for district heating, or other non-electric heating systems. Economic estimates were made for the different alternatives. The cost differences were very small for the alternatives and the economic incentive for the substitution was very good for the utilities, but not sufficient for the house owners. In one of the areas, an investment subvention of about USD 220/kW was offered to the house owners for connecting to the district heating system, which resulted in that over 75 % opted for connecting. (Numerous diagrams).

18769 (CONF-9110375–, pp. 25-28) **Basic studies on structuring intelligent base for wastes control expert system.** Tojo, Y. (Hokkaido University, Sapporo (Japan)); Matsufuji, T.; Tanaka, N.; Kamiyama, K.; Hanehara, H. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

Properly carrying out the wastes disposition business is an indispensable task that the autonomous organizations face, but the criteria and methods have not necessarily been established to rationalize the business. Therefore, for the purpose of structuring an expert system to diagnose or plan a wastes disposition business, analysis was made on the patterns of conceptions that professional people would take when they diagnose or plan the business, and an attempt was made to put the related knowledges in order. What are required in the attempt include a diagnosis whether the wastes disposition business carried out by each autonomous body is adequate, a quantification of the evaluation criteria, an extraction of problems, professional knowledge for establishing alternatives, and experiences turned into an intelligence base. To quantify the business evaluation criteria, an endeavor was made to prepare a data base, statistics and graphs based on national survey materials. As a result, it was clarified that the unit generation requirement (amount of waste generation per capita), for example, has a correlation with the statistics on the population size and that the disposition expense and ten other items can be put in order quantitatively. 2 refs., 7 figs.

18770 (CONF-9110375–, pp. 85-88) **Survey and research report on construction of refuse depository.** Takita, H. (Kawasaki Municipal Office, Kawasaki (Japan)); Ishiwatari, K.; Funabashi, H.; Kato, S. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

A refuse station (depository) carries an important function as an elementary discharge location for the refuse disposition system. This paper describes a survey on actual conditions of 27,000 depositories in the city of Kawasaki (one depository per 15 to 20 households) to extract problems and put specific corrective measures in order. Items enumerated as a result include improvement of wastes scattering and sanitary aspects, quantity reduction, measures for wastes recycling, improvement of working environment in wastes collection works, and introduction of new systems in redeveloped areas. For example, in spite of guidance on the way of discharging wastes such as use of containers, the actual discharge is done using bags, which cause wastes to be scattered by acts of cats and crows, whereby an introduction of well unified containers is proposed. Equally important is better control of the depositories, assurance of the station space, and legislation to implement these activities. Chute collection, vacuum collection, and even taking advantage of underground and developing amenity are the must in view of the collection efficiency and consistency with the wastes sorting.

18771 (CONF-9110375–, pp. 89-92) **Development of wastes sorting and disposition system for high-rise office buildings.** Oshikata, T. (Taisei Corp., Tokyo (Japan)); Usui, N.; Sakai, Y.; Okabe, Y.; Sekikawa, T. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

An introduction is given on a system that can sort and transport wastes efficiently and cleanly which are generated within office buildings, in the environment where the quantity of wastes are increasing year by year rendering more problems. Wastes generated in each story are collected by collection operators using the collectors (polyethylene bags bound on a trolley) which are put into chutes as they are. The chute has a two step structure with which wastes in the bags are fallen, bound, cut and then encapsulated. The kinds of bags are determined automatically. Bags fall down through the chute upon receiving signals from a control equipment. Bags make soft landing as the air pressure in the chute is measured and adjusted by adjusting an exhaust opening. Then, the chute bottom plate opens to place the bags on a sorting equipment where the bags are sorted out according to the bag type signal, and accommodated in a storage. The falling speed was found controllable as a result of preliminarily experimenting the falls from a height of 16 meters. 4 figs., 2 tabs.

18772 (CONF-9110375–, pp. 93-96) **Development of vacuum collection system of wastes generated by business organizations.** Inukai, S. (Shin Meiwa Industry Co. Ltd., Hyogo (Japan)); Fujita, E.; Egashira, K. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese).

From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

The wastes generated by business organizations have a problem that the wastes are large in volume and specific gravity and more difficult to suck, in addition to a large amount of generation at one place, compared with household wastes. A vacuum collection system of wastes generated by business organizations was proposed in this paper to solve these problems and a crusher and a rotating mixer suitable for this system were developed. The design principle of the crusher intended to get wastes of which size and weight could be sucked and transported in a transportion pipe. It was found from the crushing test results that some wastes could not be crushed to the forecasted size as for the size after crushing but the specific weight became smaller than the forecasted one, so that plugging could not be found at the waste suction after crushing. The rotating mixer does not require any power and control other than the drum rotating force. Further, when crushed wastes plug near the joining part between the rotating mixer and waste transportation pipe, the agitating plate projected from the waste storing and discharging mechanism can push the plugged wastes away by the rotating force to release the plugging. 9 figs., 2 tabs.

18773 (CONF-9110375–, pp. 97-100) **Development of transportation system with waste capsules.** Mizokami, Y. (Engineering Advancement Association of Japan, Tokyo (Japan)); Oda, S.; Maeda, M.; Inoue, M.; Rikuta, A. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

The deterioration of traffic stagnation and the rise of labor cost affect directly the waste processing and disposing cost for the waste transportation. Moreover, noise, vibration and exhaust gas by the waste transporting vehicles are a big problem when some new waste incineration plants are to be constructed. A new transportation system with waste capsules without automotives was developed to solve these problems in this research. The capsule transportation is a transportation system for wastes where wastes to be transported are loaded in bulk in containers, and capsule cars loaded by containers are moved in a pipe line by compressed air. As a result of a demonstration test, it was verified that this transportation system with waste capsules could be used practically. The simulation program by which any basic plan for the transportation system with waste capsule was simulated with the computer was developed so that many municipalities could simply study the contents to introduce this system. 3 figs.

18774 (CONF-9110375–, pp. 101-104) **Transportation experiment of waste capsules.** Mizokami, Y. (Engineering Advancement Association of Japan, Tokyo (Japan)); Oda, S.; Obata, H.; Kamiya, O.; Tada, K.; Yamanishi, T. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This paper describes the running characteristic experiment and the crude refuse transportation experiment to confirm that the capsule transportation system is effective and suitable to transport urban wastes. It was confirmed from the result of running characteristic experiment that the effectiveness factor and the resistance coefficient to rolling run were very near the design values and the basic data could be obtained. It was clarified that capsule trains on which capsules packed by wastes were loaded, started, ran and stopped smoothly, holding the very stable condition. The noise was very quiet by the measurement. In addition, it was confirmed by the crude refuse transportation experiment that the cover lock seal was certain for the shaking, vibration and the adjusted speed during the running. Dirty watery or odor leaked hardly and the odor did not adhere to the pipeline. The loaded condition did not change and uneven distribution of packed wastes could not be found. The suitability of this system was proved. 3 figs.

18775 (CONF-9110375–, pp. 105-108) **Development of capsule and compressive packing and discharging equipment for the transportation system with waste capsules.** Mizokami, Y. (Engineering Advancement Association of Japan, Tokyo (Japan)); Oda, S.; Yamane, K.; Fujita, E.; Inoue, M.; Arima, Y. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

Capsules and the compressive packing equipment and the discharging equipment are the main facilities in the waste capsule transportation system. The capsule and the compressive packing equipment were trially manufactured to carry out the developing experiments. Trially manufactured capsule has the cylindrical body on which both ends removable covers of the same shape are fitted. The compressive packing equipment and the discharging equipment are installed separately but for the developing purpose, these combined equipment was trially manufactured to carry out the compressive packing experiment and the discharging experiment separately. As a result, the maximum packed weight of 150kgf per one capsule (waste of 0.73 bulk specific gravity) could be obtained. Since the cycle time periods were 80 seconds for the compressive packing process and 45 seconds for the discharging process, the processing capacities for the compressive packing and the discharging equipment were respectively 6.8tf and 12tf. These values satisfied sufficiently the initial design conditions. 1 refs., 6 figs., 2 tabs.

18776 (CONF-9110375–, pp. 121-124) **Energy analysis of a factory utilizing refuse disposal fuel.** Matsufuji, T. (Hokkaido University, Sapporo (Japan)); Tanaka, N.; Nishikawa, H.; Kamiyama, K. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

The power generation and waste heat utilization in many waste incineration facilities are one of the effective uses of wastes and the promising alternative system is the manufacture of the refuse disposal fuel (RDF). The energy analysis was made for a factory in Sapporo using RDF manufactured from general waste originated from business organizations as a fuel. For the comparison, the energy analysis was also made for the Shinoro Waste Incineration Plant in Sapporo as an example of the conventional waste incineration and power generating plant to evaluate the both systems. The system evaluation was made on the basis of the energy analytical approach. When the RDF manufacturing and utilizing system is compared with the waste incineration system, energy gains are nearly equal, indicating that the RDF manufacture is a promising refuse utilizing system. When evaluating from the viewpoint of the energy amount taken out to the outside, the RDF system is superior to the conventional system. But since the refuse used for RDF has high calorific value and the quality of production energy is different between both systems, the evaluation based on the energy gains may not be correct. 5 refs., 2 figs., 4 tabs.

18777 (CONF-9110375–, pp. 125-128) **Possibility of snow disposition in urban areas using cleaning plants located in urban areas.** Kobayashi, M. (Hokkaido University, Sapporo (Japan)); Yoroi, E. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

The present study discusses the effectiveness of installing cleaning plants in an urban area with that of the city of Sapporo as an example, from the viewpoints of both of snow melting capability and energy reduction in snow disposition. The system discussed in this study, with a provision of installing cleaning plants in an urban area, utilizes steam generated from incineration waste heat multiply in a sequence from the high-heat side to power generation, regional cooling and heating, and snow melting. Cleaning plants are to be built underground below parks to minimize the aboveground portions, and wastes are collected using a vacuum refuse collecting pipe system. Calculations were performed on an overall energy balance where the quantity of heat is varied in three steps, which is allocated to the regional cooling and heating and the snow melting out of the quantity generated from power generating turbines. As a result, it was proved that, when 70% of the turbine discharged heat is allocated to snow melting and heat storage or snow storage tanks for three snow days worth are installed, the incineration of refuses generated in a region can take care of melting snow to be removed from roads in the region. 4 figs., 1 tab.

18778 (CONF-9110375–, pp. 173-176) **Analysis of convenience cost generated from large city cleaning business.** Matsuoka, S. (Hiroshima University, Hiroshima (Japan)); Matsumoto, R. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This paper focuses on the problem of final treatment plants for general wastes produced in large cities and analyzes the convenience cost generated from large city cleaning business. In doing so, the work takes note of the refuse quantity reduction by means of sorted refuse collection (recycling) as one of the practicable social framework that enables reducing the evil necessity of disposing refuses dependent upon land refilling, thereby clarifying the advantages in financial management. In addition, this paper introduces case studies for the city of Hiroshima, a city most advanced in performing the sorted refuse collection among the twelve large Japanese cities. As a result of this analysis, it was clarified that advantages are generated in the entire refuse disposition business when the refuse producers bear a chance expense in carrying out sorting out the refuses which results in the refuse quantity reduction. Further, though not emerging on the effect of tonnage of refuse collection and transportation, effects can be expected in reducing the refuse disposition cost per citizen, as well as financial effect in reducing expenses required in interim and final refuse dispositions. 4 refs., 4 figs., 1 tab.

18779 (CONF-9110375–, pp. 361-364) **Primary estimation on quantity of greenhouse-effective compounds discharged from waste incinerators.** Watanabe, M. (The Institute of Public Health, Tokyo (Japan)); Miyazaki, M.; Tanaka, M.; Otsuka, Y.; Takahahsi, T.; Shoji, N. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This study discussed method of sampling test pieces and analyzing constituents to estimate quantities of compounds having relation with the earth warm-up problem, discharged from waste incinerators. Discharging conditions were surveyed at actual facilities, and the quantities of nationwide discharge were stochastically calculated using the survey data as the basis. The conventional test piece sampling method was followed, and partly improved absorbent system was used. The constituent analyzing method followed the conventional gaschromatograph method which was improved to a simple and high-accuracy method. As a result of the analyses on CO_2,N_2O, CH_4 and CO, approximate values of 27 Tg, 1 Gg, 10 Gg and 200 Gg were obtained respectively. These values do not have necessarily high accuracy because of calculations based on a relatively few number of actual surveys, but may be useful as a primary estimation. That is, some references were obtained that the calculated CO_2 discharge quantity corresponds to 3% of the discharge quantity (895 Tg) attributable to the nationwide fossil fuel consumption, and that CH_4 has the largest discharge quantity from among the fixed generating sources surveyed to date. 9 refs., 1 fig., 3 tabs.

18780 (CONF-9110375–, pp. 365-368) **Discussion on stochastic expressions for lower order calorific value of wastes.** Tanigawa, N. Nemoto, H. (Tokyo Metropolitan Cleansing Laboratory, Tokyo (Japan)). Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

Various kinds of stochastic expressions for lower order calorific value are used to measure calorific values of wastes. The estimated values may have a large deviation from measurements using a calorimeter. This study carried out comparisons of measurements of lower order calorific values for wastes produced in the Tokyo Metropolis with various measurement values taken for five years from 1984 to 1988, and proposed new stochastic expressions for lower order calorific values of wastes. The Tokyo Metropolitan Government has been performing ash content measurements, element analyses and calorific value measurements by means of pulverizing and reducing dry refuses removed of noncombustible materials to prepare test specimens for chemical analyses, and has been making calculations of lower order calorific value of wastes. Then, the government has proposed expressions to estimate the lower calorific values on wet basis from the dry base physical composition and total moisture in the wastes, using the mean value for the dry base lower order calorific values of each item as the coefficients. It also carried out comparisons of the estimated values obtained from various stochastic expressions with the measurement values. As a result it was proved that the estimated values from the proposed stochastic expressions agree nearly with the measurements. 9 figs., 2 tabs.

18781 (CONF-9110375–, pp. 369-372) **Development of intelligent combustion control system for waste incineration furnaces.** Hino, M. (Kubota Corp., Osaka (Japan)); Takahata, Y.; Inoue, Y.; Nishio, S.; Imamura, F.; Oniuda, K. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

Automatic combustion control (ACC) system has now been used widely in recent years with the PID control as the main control system for municipal waste incinerators. However, waste incinerators may develop long and largely varying wasteful time and time delay making them difficult for the PID control. Accordingly, this study has developed an intelligent combustion control (ICC) system for waste incinerators applied with the artificial intelligence (AI) technologies to realize a touch-free operation. The ICC system inputs process data sampled on 30-second cycles and image data from a in-furnace monitoring camera, and transmits control signals as the estimated results to each control device via a programmable controller. The system comprises a signal collecting computer, an estimating computer and an event recorder. This system was verified as an effective control system suitable for waste combustion having large amount of wasteful time and time delay. 4 refs., 5 figs.

18782 (CONF-9110375–, pp. 373-376) **Refuse feed control in municipal refuse incinerators using fuzzy theory.** Nagasawa, T. (Sanki Engineering Co. Ltd., Tokyo (Japan)); Saito, S.; Takahashi, K.; Miyata, H.; Matsufuji, H.; Iijima, K. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

With the purpose to deftly control the quantity of refuses to be fed into a refuse incinerator depending on variations in natures of the refuse characters, this study applied a fuzzy theory to control a refuse extruder stroke in a refuse incinerator of semi-continuous type. This system, applied with the fuzzy theory, judges comprehensively the items of information on a quantity of refuses thrown into a hopper, flue gas temperatures, flue gas amounts, and refuse characters, and controls the stroke of a refuse extruder to feed refuses into an incinerator. The fuzzy control uses the MAX-MIN inference theory as the inference system, and uses the method of elastic center to calculate conclusion values. As a result, stable combustion was realized from the rise-up to steady combustion. The system improved the flue gas and combustion ash properties, and demonstrated its usefulness in feed quantity control for controlled combustion. The fuzzy control is a very useful means as a technology to judge comprehensively the information difficult to quantify the refuses, and control the refuse feed quantity. 2 refs., 6 figs., 2 tabs.

18783 (CONF-9110375–, pp. 377-380) **Behaviors of waste incinerators discharging hazardous materials at rise-up.** Yasuda, K.; Takahashi, M.; Yajima, I. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This study performed measurements of concentrations of toxic substances such as polynuclear aromatic hydrocarbon (PAH) and metals discharged from city waste incinerators at rise-up, steady and banking combustion, to compare and discuss their discharge behaviors under various operating conditions. Carbon concentration was measured simultaneously in dusts collected at electric dust collectors to identify combustion conditions in the incinerators. As a result, the PAH concentration was found rising high at a rise-up of the incinerators when incomplete combustion tends to occur. Particularly fluidized bed incinerators, in which combustion is unstable causing high CO concentration in flue gas, had a discharge ratio of PAH more than ten times greater than in step grate incinerators. In fluidized bed incinerators, when the CO concentration in flue gas is high at a rise-up, dusts and metals contained in the dusts such as Cd, Pb, Cu, Zn and Mn were found tending to become high in concentration in proportion to the CO concentration. Carbon content in EP ash was highest when an incinerator was rising. 6 tabs.

18784 (CONF-9110375–, pp. 385-388) **Survey on tube wall thinning in waste incinerator boilers.** Urabe, T. (Tokyo Metropolitan Cleansing Laboratory, Tokyo (Japan)); Honda, T. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

A combustion control method has been implemented as one of the reduction measures of NO_x in flue gas. The method uses a low O_2 operation, which had the problem of wall thickness decrease in overheater pipes and evaporator tubes in upper part of a furnace chamber, which is thought to have been caused from the low O_2 operation. Therefore, a survey was carried out on conditions of corrosion in cross sections of boiler water pipes actually had thinned wall or rupture, as a part of the survey on actualities of boiler water pipe corrosion intended to cope with the problem. The survey was conducted on boiler tubes (STB35) which suffered relatively severe thinning. As a result, it is suggested that the pipe surface temperature has not reached so high as to cause a structural change in the base material; scales can not be dense and contain fair amount of cracks and crevices; elements such as S, Cl, Na and Zn are often distributed near the interface between the scales and metals; and gas and deposited ash constituents should have influence on the corrosion mechanism. It is clear that the pipe wall thinning related to combustion conditions should have been caused primarily from the low O_2 operation. 3 refs., 3 figs., 1 tab.

18785 (CONF-9110375–, pp. 465-468) **Reduction of dioxin discharged from waste incinerators of water spraying and gas cooling type.** Yamazaki, M. (Sumitomo Heavy Industries, Ltd., Tokyo (Japan)); Sanada, K.; Sumitomo, M.; Kawakami, I. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This study is intended to survey on discharge reduction in dioxin and other substances by means of changing operation methods in waste incineration facilities currently in operation. Two survey experiments were carried out on actual incinerators. In addition to dioxin, measurements were performed on such compounds as carbon monoxide (CO), total hydrocarbon (THC), chlorobenzene (CB) and chlorophenol (CP). As a result, when the correlation between CO and $PCDD_S$ + $PCDF_S$ is observed, it is evidential that their generating conditions in the after-stage devices can work effectively as distinctive parameters, hence obtaining CO concentration alone even with data from the same facilities would be difficult to put the conclusion in order. Though being a trace substance, CB, CP and dioxin furan have extremely high correlation and reproducibility, which suggest a generation under the same conditions. The generation rate varies with shapes of heat transfer pipes in the air preheater, method of dust discharge and the operation histories. Much larger amount of dioxin was produced in the air preheater than had been anticipated. 6 refs., 2 figs., 2 tabs.

18786 (CONF-9110375–, pp. 469-472) **Operating-conditions and dioxin in city waste incinerators equipped with incinerator-integrated gas cooling chamber.** Nagasawa, T. (Sanki Engineering Co. Ltd., Tokyo, (Japan)); Saito, S.; Takahashi, K.; Hamazaki, M.; Sato, Y.; Miyata, H. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

With respect to controlling operations of city waste incinerators to reduce dioxin discharged from them, appropriate actions are required to comply with conditions for respective incineration facilities. Accordingly, a survey was carried out on step stoker incinerators equipped with an incinerator-integrated gas cooling chamber and electric dust collector. As a result, keeping the gas temperature at the electric dust collector inlet below 280°C decreased sharply the dioxin regeneration. If the gas temperature at the electric dust collector inlet is the same, the lower the CO concentration, the dioxin generation quantity was smaller. An effective method to lower the CO concentration was to reduce the primary air ratio. Controlling the operation using the O_2 concentration as an operating parameter could result in the same effect as CO control. The higher the combustion temperature, the lower the CO concentration, although the NO_x consentration will be high. Therefore, in a facility, which has no special NO_x removing equipment, it would be better to set the combustion temperature to an upper limit of about 930°C. 3 refs., 4 figs., 1 tab.

18787 (DOE/BP–1739-Vol.2) **1991 Pacific Northwest loads and resources study: Technical appendix: Volume 2.** USDOE Bonneville Power Administration, Portland, OR (United States). Dec 1991. 645p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011542. Source: OSTI; NTIS; GPO Dep.

The 1991 Pacific Northwest Loads and Resources Study establishes the Bonneville Power Administration's (BPA) planning basis for supplying electricity to BPA customers. The Loads and Resources Study is presented in three documents: (1) this technical appendix detailing loads and resources for each major Pacific Northwest generating utility, (2) a summary of Federal system and Pacific Northwest region loads and resources, (3) a technical appendix detailing forecasted Pacific Northwest economic trends and loads. This analysis updates the 1990 Pacific Northwest Loads and Resources Study Technical Appendix published in December 1990. This technical appendix provides utility-specific information that BPA uses in its long-range planning. It incorporates the following for each utility: (1) Electrical demand–firm loads–under the medium

1991 Joint Load Forecast; (2) Generating resources; and, (3) Contracts both inside and outside the region. This document should be used in combination with the 1991 Pacific Northwest Loads and Resources Study, published in December 1991, because much of the information in that document is not duplicated here.

18788 (ENET–9100228/1) **Energy concept, renovation of Uster indoor swimming pool.** Kannewischer, B. Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Dec 1989. 32p. (In German). Order Number DE92515359. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

As part of the renovation and reconstruction of the Uster indoor swimming pool, the entire technical equipment was replaced which allowed the implementation of an optimum energy concept. The first year of operation showed that the energy use of the renovated pool was only 60% although the water area has been increased by approx. 70%. The heat use has been reduced by around one-third whilst electricity consumption has doubled. The increased electricity requirement is a direct result of the doubling of the water area and for the operation of the heat pump. The indoor pool has a very good energy index of 168 MJ/m3a. figs., tabs.

18789 (Juel–2536) **High temperature incineration of municipal wastes using TAZAS-process. A review.** Ringel, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie. Oct 1991. 30p. (In German). Order Number DE92506963. Source: OSTI; NTIS (US Sales Only).

A process for thermal waste treatment with the destruction or separation of hazardous components (TAZAS process -Verfahren zur thermischen Abfallbehandlung unter Zerstoerung oder Abtrennung der Schadstoffe) is being developed at the Research Centre Juelich. This new process is characterized by the incineration of waste with concentrated oxygen at high temperatures, the production of a mineralized slag and the recycling of filter dust into the incinerator. Almost all the filter dust is fused into the slag thus dispensing with the need for a disposal of the filter dust. The heavy metals are leached from the dust by the off-gas condensate and may thus be recovered by wet chemistry methods. For this process development pilot experiments have been cariied out. The waste was incinerated at 1350 deg C with pure O_2 in a special swing furnace with a throughput of 10 kg/h. Although the system has not yet been optimized it already provided a high incineration quality (CO or C_nH_m content in the off-gas 30 ppm and 7 ppm respectively, residual carbon in the slag 20 ppm). The leach resistance of the slag is very high, comparable to that of natural basalt. Filter dusts polluted by heavy metals were also incinerated. The matrix elements of the dust were fused into the slag and at the same time the volatile heavy metals were forced into fine dust. The accumulation of cadmium, for example, on the fine dust increased by a factor of 300 relative of the waste. This greatly improves the recovery of heavy metals by leaching the dust in the acid condensate. (orig.).

18790 (NEI-DK–798) **Natural gas driven gas turbine systems in Denmark: Description of plants and operation experience.** Petersen, F. (I. Krueger A/S (DK)); de Wit, J. Dansk Gasteknisk Center A/S, Hoersholm (Denmark); Krueger (I.) A/S, Copenhagen (Denmark). Sep 1991 81p. (In Danish). Order Number DE92506327. Source: OSTI; NTIS (US Sales Only).

Combined heat and power production has high priority in Danish energy planning. Interest has increased for establishing decentralised gas fired co-generation plants based on gas engines or turbines. Approximately 60 gas engines and 10 gas turbines have been installed. These numbers are expected to increase significantly. Most units have been placed at district heating plants or for the supply of blocks of flats. There is great technical potential for co-generation in industry. This market is waiting for shorter pay back time. Today 10 gas turbine co-generation plants are operational with a mechanical rating from 600 kW to 17 MW. There have been problems with condensation of ventilation air on the generator and ice at the air inlet. Short time heat storage facilities insulated hot water tanks are installed in 6 of the plants. Danish plants can expect a reliability from 90-95%. The annual electricity production efficiency is in the range of 21-30% for the simple cycle plants, total fuel utilisation is from 80 to 97%. New plants must, meet a maximum emission of 200 mg/MJ CO for CO and NO_x at full load. NO_x is calculated as NO_2. The emission of carbon monoxide and unburned hydrocarbons from the gas turbines are low. Supplementary firing can increase the emission of these components significantly. Most plants have been established with investment costs varying from 6000 to 10,000 dkr/kW$_e$. The operation and maintenance cost are generally, approximately 0.03 dkr/kWh$_e$. (AB) 11 refs.

18791 (NEI-DK–817) **Renovation and development of smaller straw boilers for manual firing 2.** Lund, E. Dansk Teknologisk Inst., Taastrup (Denmark). Feb 1992 42p. (In Danish). Contract ENS-UVE-90.0064. Order Number DE92506383. Source: OSTI; NTIS (US Sales Only).

Results of tests in relation to smaller straw-fired boilers are presented in continuation of a former project of the same title (1) where the chimney outlet was unsatisfactory. This condition has since been improved by adding a flue gas ventilator. It is stated that the Danish government will demand an improvement in the combustion of straw so that the air pollution it causes will be reduced, this should result in a better economy in relation to straw-fired heating plants. Straw is a cheap fuel, and its use will not be subjected to taxes on carbon dioxide emission, it is claimed. The test results are presented in detail. It was found that the combustion worked its way to the back of the straw, but that the temperature was constant at the outlet for flue gas. There seems to be a clear relation between the temperature and the CO_2, and of the CO, content of the flue gas. (AB).

18792 (NEI-DK–818) **Investigation in relation to the establishment of a gasification system in Denmark: Draft project.** Nellemann Raadgivende Ingenioerer og Planlaeggere A/S, Aarhus (Denmark). Jan 1992 19p. (In Danish). Contract TR-87.198. Order Number DE92506382. Source: OSTI; NTIS (US Sales Only).

The aim was to investigate the potentials for establishing decentral cogeneration plants based on the gasification of straw or wood chips, and a district heating plant in Lemvig, Denmark, was examined in this respect. It appeared that the operation of this plant was economically sound. When subsidies were to the amount of 230 Danish crowns per MWh produced electricity it was possible to produce electric power during hours where consumption was low, which meant that it can be possible to produce electricity more cheaply when using gas from wood chips than with natural gas. It was found that it was thus also possible to use a smaller motor system, which lowers investment costs, but the actual motor has to be slightly larger when using gas from wood chips than when using gas from natural gas. The economical aspects are described in detail. (AB).

18793 (NEI-DK–823) **3.025 m^2 solar collector system at Ry heating plant.** Nellemann Raadgivende Ingenioerer og Planlaeggere A/S, Aarhus (Denmark); Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark); Scan-Con Solvarme ApS, Skoerping (Denmark). [1991] 61p. (In Danish). Contract SE/00555/86/DK. Order Number DE92506373. Source: OSTI; NTIS (US Sales Only).

Cover titel: 3.025 m^2 solfangere ved Ry fjernvarmevaerk.

The aim was to develop a system of solar collectors in relation to a district heating plant and to instigate energy saving possibilities by establishing low temperature operation in an actual plant located at Ry, Denmark. It was found that the efficiency of the solar collectors was significantly increased by sinking the temperature in the district heating system. The project is described in considerable detail. Performance data sheets are included in addition to data on fuel savings, costs and heat production etc. (AB).

18794 (NEI-DK–835) **Guidelines note: Preparation of project proposals for the conversion of a district heating plant to cogeneration.** Energistyrelsen, Copenhagen (Denmark). Feb 1992 62p. (In Danish). Order Number DE92506469. Source: OSTI; NTIS (US Sales Only).

The Danish law on heating supplies dictates that a number of district heating plants shall work out proposals for conversion to the cogeneration of heat and electricity. The project proposals must be authorized according to the law on heat supply and also by the authorities according to the law on electric power supply. The relevant regulations are cited. The note aims at showing a concrete example of how a proposal for a project for the conversion of a district heating plant to cogeneration, addressed to the authorities, could be worked out. The administrative processes of authorizaton are explained. (AB).

18795 (NEI-NO--206) **Optimization of design values in district heating substations by system simulation.** Hjorthol, E.M. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1990 128p. Order Number DE92506543. Source: OSTI; NTIS (US Sales Only).

This work is devoted to a study in system performance of district heating consumer substations with focus on design optimization in hot service water systems. District heating consumer substations are installed in every building connected to a district heating network, and act as energy transformers between the district heating network and the consumer installations. These are typically space heating, ventilation air heating and hot service water production systems. The primary mission of these consumer substations is to provide the consumers with sufficient amounts of energy, at stable temperature levels. The secondary purpose of the consumer substations is to give the primary water sufficient cooling, which is a requirement for the proper performance of the total district heating system. These basic demands are not always met in practice, and this gives grounds for a detailed study of the system performance of district heating consumer substations. A wide scientific analysis of this topic requires a simulation tool to make parameters studies and variation possible. A considerable part of this work therefore concerns the development and systematization of time-dependent mathematical models and their verification. A dynamic simulation tool is also adapted to the special task of multicomponent dynamic system simulation. Because the systems consist of components, it is possible to simulate the system performance by collectively simulating the performance of the interconnected components. The simulation tool makes it possible to analyse the systems during different operating conditions and with various parameter settings. 34 refs., 69 figs., 11 tabs.

3209 Education and Public Relations

Refer also to citation(s) 18699

18796 (DOE/CE--0355P) **Comprehensive program and plan for Federal energy education, extension, and information activities: Annual revisions: The fifteenth report to Congress.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Office of National Programs. Nov 1991. 78p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012446. Source: OSTI; NTIS; GPO Dep.

The future success of the United States in meeting its energy challenges depends on the development of human resources as well as the wise use of natural resources. To make well-informed decisions about energy issues, the public needs to be technically informed. To carry out critical technical responsibilities, the Nation relies on knowledgeable professionals. The CPP is a summary of the energy-related information gathering and dissemination activities of more than a dozen Federal agencies during the 1991 fiscal year. The programmatic activities reach a wide range of markets and audiences. This document highlights the activities and accomplishments of Federal energy education, information, and extension programs and lists key personnel who may be contacted for further information. It is intended to be a resource to individuals and organizations having an interest in energy education, extension, and information activities.

18797 (DOE/NE/44139--66) **West Valley Demonstration Project Community Relations Plan, FY 1992/93.** Chamberlain, J.D. West Valley Nuclear Services Co., Inc., West Valley, NY (United States). Sep 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-81NE44139. Order Number DE92012578. Source: OSTI; NTIS; GPO Dep.

The West Valley Demonstration Project (WVDP) Community Relations Plan establishes a framework of community outreach activities through which to provide the public current, accurate WVDP information, respond to public inquiries, and to receive comments from interested individuals and organizations. An open, effective community relations program is essential to developing public understanding of WVDP goals and direction. The mission of the WVDP is to solve an existing environmental concern by solidifying high-level nuclear waste, transporting the solidified waste to a federal repository for permanent disposal, and effectively closing the facilities used. As an environmental restoration and radioactive waste management project, being conducted at the site of a former nuclear fuel reprocessing facility, the WVDP is a matter of considerable public interest. Safe, effective site operations and the development of technology to meet WVDP goals are both focal points for interested individuals, technical organizations and societies, and environmental and educational groups.

33 ADVANCED PROPULSION SYSTEMS

Refer also to citation(s) 18724

3301 Internal Combustion Engines

Refer also to citation(s) 17884, 18807

18798 (CONF-9203108--1) **Nondestructive testing of ceramics for vehicular advanced heat engines.** McClung, R.W. (McClung (R.W.), Powell, TN (United States)); Johnson, D.R. Oak Ridge National Lab., TN (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 American Society for Nondestructive Testing (ASNT) spring conference; Orlando, FL (United States); 30 Mar - 3 apr 1992. Order Number DE92010471. Source: OSTI; NTIS; GPO Dep.

Transportation is the largest petroleum user in the United States, accounting for about two-thirds of the total use. Of this, over 80% of the transportation fuels are consumed in roadway vehicles. The need for improvements in transportation fuel efficiency is clear. As one approach toward the solution of this problem, there has been expanded research into new automative propulsion systems. One phase of this development has been for advanced heat engines such as the automative gas turbine and low-heat rejection diesel engine. The improved energy efficiency depends on the ability of such engines to operate at very high temperatures by using high-temperature structural materials. Advanced structural ceramics are the materials of choice. However, current limitations in reliability of advanced ceramics have required extensive research and development to overcome the problems. A major program is being funded by the Department of Energy, Office of Transportation Technologies. Nondestructive testing (NDT) is a vital part of that program. Development and application of advanced NDT are being performed by several ceramics producers, engine fabricators, research and development organizations and NDT companies. Advanced and improved techniques are being studied for examination of ceramics at all stages of fabrication from the starting raw materials through intermediate stages, to the final finished product.

18799 (Juel--2564) **Low-polluting oil-vapor engine.** Foerster, S. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie. Dec 1991. 20p. (In German). Order Number DE92511719. Source: OSTI; NTIS (US Sales Only).

The oil-vapor engine presented here is based upon the vaporization without residues of diesel fuel or similar fuel oils under pressure in superheated water vapor. The oil/water vapor mixture is directly injected into the combustion chamber, and the energy for prducing the water vapor is taken from the engine exhaust gas. This oil-vapor engine ensures low-polluting low-toxic combustion - characterized by strongly decreased NO_x-production and avoidance of soot. Most important for this aspect, as well as for a decreased specific fuel consumption, is the intensive and rapid formation of the oil/water vapor during combustion. On the basis of fundamental experimental examinations, the oil-vapor engine is best suited for diesel operation with direct injection of the oil/water vapor. (orig.).

18800 (NEI-DK--834) **Adaptive control of a petrol engine's spark ignition angle.** Eksamensprojekt - IMSOR, 31/91. Bechmann, H. Technical Univ. of Denmark, Lyngby (Denmark). Inst. of

Mathematical and Operations Research; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Servolaboratoriet. 1991 170p. (In Danish). Order Number DE92506389. Source: OSTI; NTIS (US Sales Only).

As the volume of car traffic is increasing so quickly it becomes more vital to reduce the energy consumption of road vehicles. One way of doing this is to develop the control systems that regulate the fuel injection and the time of ignition. Correct control of the ignition angle has a significant influence on the motors driveability. The process of working with an adaptive regulator (extremum controllers) for the control of the spark ignition angle in order to indicate to the maximum level of efficiency in the motor is described. Various designs were developed and tested by means of computerized simulation. The first part was based on the assumption that the indicated level of efficiency can be measured, and here it was possible to achieve perfect control of the spark ignition angle. Furthermore, a regulator was developed which controlled the spark ignition angle on the basis of measurements of the number of revolutions. Here the control was excellent, but not quite perfect. (AB) 22 refs.

18801 (UCRL-JC--109673) **Autoignition behavior of lean mixtures: Chemical and thermodynamics effects.** Ronney, P.D. (Princeton Univ., NJ (United States). Dept. of Mechanical and Aerospace Engineering); Shoda, M.; Waida, S.T.; Westbrook, C.K.; Pitz, W.J. Lawrence Livermore National Lab., CA (United States). 15 Jan 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707--24: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92009690. Source: OSTI; NTIS; GPO Dep.

Knock characteristics of natural gas (NG), 89 octane unleaded gasoline, 2,2-dimethyl butane (22DMB), and methyl tert-butyl ether (MTBE) in stoichiometric and lean fuel-air mixtures were studied in a production 4-cylinder automotive engine. The Intake Temperature at the Knock Limit (ITKL) was different for each fuel but always higher in lean mixtures. Gasoline and 22DMB exhibited much greater increases in ITKL than MTBE and NG at lean conditions. Surprisingly, for lean mixtures 22DMB exhibited higher ITKL than MTBE and was almost as high as NG. Comparison with detailed numerical modelling was very favorable. Computations show that both differences in chemistry and end-gas temperature and pressure histories are responsible for these trends. This behavior is interpreted in terms of the Negative Temperature Coefficient behavior of hydrocarbon oxidation. The implication of these results for the specification of optimal fuels for lean-burn engine is discussed.

18802 Electrically actuated gaseous fuel timing and metering device. Green, C.J.; Wallace, J.S. To Univ. of Toronto Innovations Foundation (Canada). 8 Nov 1991. Filed date 8 May 1990. Canada Patent patent application 2016284. 32p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A device for timing and metering gaseous fuels into an internal combustion engine has a cylindrical solenoid cavity with a portion projecting away from the cavity containing a bore coaxial with the cylindrical cavity. The portion also has gas passageways. An injector tip is secured to the portion so that it can be adjusted in position toward and away from the cavity. The injector tip has an orifice, and a valve head on a pintle moving in the bore is adapted to open and close the orifice. The other end of the pintle is secured to the armature of a multipole solenoid which includes a plurality of plate-like, spaced ribs covering a substantially circular configuration and located within the cavity. The length of the pintle is such that, when the head is seated against the valve seat to close the orifice, the armature is spaced from the ribs, and when the armature is seated against the ribs, the head is off the valve seat, thus opening the orifice. Among a number of different uses, the device of the invention can be employed for timed port injection of compressed natural gas into a two-stroke diesel engine. 13 figs.

18803 Advanced gasification enhancement system or A.G.E.S. Penner, F.R. 17 Oct 1991. Filed date 17 Apr 1990. Canada Patent patent application 2014615. 7p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

In the operation of a liquid fueled internal combustion engine, it is known to have a fuel system that atomizes the liquid fuel in some way into the air stream inducted into the combustion chamber. This combustible mixture is inducted into the combustion chamber through a manifold that feeds each cylinder of the engine. In almost all cases an attempt is made to heat this mixture in some way in order to gasify the fuel on its way to the combustion chamber. According to an invention which provides a process that accomplishes complete gasification of the atomized liquid fuel before entrance into the air stream, the fuel is first atomized by injection into the presence of a hot inert gas. This gas may be the exhaust gas of the engine that is being fueled, or it may be steam produced by water that is heated by the excess heat of the exhaust gas stream produced by the engine. This action produces instantaneous gasification of the fuel, and this gas mixes with the hot inert gas in the chamber where the hot inert gas is present. This mixture is then introduced into the air stream that is inducted into the engine, now becoming a combustible mixture. At this point the combustible mixture need only be maintained at a high enough temperature to prevent precipitation of the gasified fuel while it mixes with the air stream on its way to the combustion chamber. Using the procedure of the invention, compression ratios and fuel ratios can be engineered to their best advantage, while maintaining or even lowering harmful exhaust emissions. 2 figs.

18804 Gas injection system. Djurdjevic, J. 3 Oct 1991. Filed date 3 Apr 1990. Canada Patent patent application 2013768. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Apparatus is disclosed for metering the supply of natural gas to an internal combustion engine having an air intake manifold and throttle valve mounted in the manifold. The apparatus comprises a pressure regulator for regulating the pressure of the natural gas; a sensor plate associated with the air intake manifold and movable in response to variations in the throttle; and a valve actuable by the movable sensor plate to vary the supply of natural gas to the air intake manifold in response to variations in the throttle valve so as to meter the supply of natural gas to the internal combustion engine. The apparatus of the invention may be installed initially in an internal combustion engine, or be used as a kit in order to convert an internal combustion engine to run on natural gas. 3 figs.

3303 Electric-Powered Systems

18805 (DOE/NV/10031--T1) **UHM/HNEI EV test and evaluation program: Final report.** Hawaii Natural Energy Inst., Manoa, HI (United States). Mar 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-79NV10031. Order Number DE92011631. Source: OSTI; NTIS; GPO Dep.

The electric vehicle (EV) program of the Hawaii Natural Energy Institute (HNEI) focuses primarily on the field testing of promising EV/traction batteries. The intent is to utilize typical driving cycles to develop information that verifies or refutes what is obtained in the laboratory. Three different types of battery were assigned by the US DOE for testing in this program: Sonnenschein Dryfit 6V-160, Exide GC-5, Trojan T-145. We added the following battery to the test program: ALCO2200. HNEI's existing EVs were utilized as test beds. The following EVs were chosen in our program: Converted Ford Escort station wagon, Converted Ford Escort two-door sedan, Converted Ford Escort two-door sedan, Converted Dodge van (typically daily driving distances, 10--30 miles). Capacity testing is a very effective way of monitoring the status of battery modules. Based on capacity tests, corrective action such as battery replacement, additional charging, adjusting terminal connections, etc., may be taken to maintain good performance. About 15,500 miles and 600 cycles have been accumulated on the Sonnenschein Dryfit 6V-160 battery pack. Five of its 18 modules have been changed. Based on DOE's standard, the battery has reached the end of its useful life. Nevertheless, the battery pack is still operational and its operating range is still greater than 40 miles per charge. It is too early to evaluate the life expectancy of the other three batteries, the Trojan T-145, Exide GC-5, and Alco 2200. No module has been replaced in these three packs. The Trojan T-145 battery is a very promising EV traction battery in terms of quality and reliability versus price. HNEI will keep the Trojan and Exide battery packs in operation. The Alco 2200 batteries will be transferred to another vehicle. The Additional Charging Method seems to be an effective way of restoring weak modules. The "Smart Voltmeter" developed by HNEI is a promising way of monitoring the remaining range for an EV.

18806 **Air chargers and airturbo chargers.** Dorus, V. 21 Sep 1991. Filed date 21 Mar 1990. Canada Patent patent application 2012649. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Devices are provided to produce electric power from the power of the air that hits an electric vehicle while it is in motion. The air actuates fan blades or turbines which are installed on the shaft of a generator or alternator mounted on a special reinforcement built on the electric vehicle. The electric power so produced can be used to recover part of the electric power used to move the vehicle, therefore increasing the time that the electric vehicle can run on one charge of batteries. The number of air chargers or airturbo chargers needed depends on the shape and size of the vehicle. 4 figs.

3306 Vehicle Design Factors

Refer also to citation(s) 17884

18807 (ENEA-RTI-INN-SVIL--91-22) **Alternative engine in dynamic regime: Valve clearances.** Piani, M. ENEA, Bologna (Italy). 1992. 21p. (In Italian). (RTI/INN-SVIL--91-22). Order Number DE92506235. Source: OSTI; NTIS (US Sales Only).

Alternative engines employing intake and exhaust valves usually present difficulties with regard to the control of valve clearances. Presently, the control is carried out when the engine is shut down and cold; and this control thus represents a significant amount of engine downtime. This paper presents a technique which reduces downtime and, above all, allows the valve control operation to be performed with the engine running and in the thermal regime. During performance tests on a prototype, it was possible to control the valves while contemporaneously modifying the engine operating conditions, i.e., temperature and speed.

3307 Emission Control

Refer also to citation(s) 17884, 18799

18808 **Method of and an apparatus for regenerating a diesel particulate exhaust filter.** Pattas, K.N. 22 Sep 1991. Filed date 22 Mar 1990. Canada Patent patent application 2012844. 14p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method and apparatus are provided for achieving fully automatic regeneration of a diesel particulate exhaust soot filter during operation of a diesel engine, while ensuring protection against uncontrolled regeneration or unintentional burnoff of the particulate deposited on the filter. According to the invention, the actual temperatures of the exhaust gas upstream and downstream of the filter are detected. The regenerating operation is automatically initiated when a first setpoint exhaust temperature is reached upstream of the filter during operation of the engine. The regenerating operation is automatically turned off when a second setpoint exhaust temperature upstream of the filter is exceeded. When a predetermined exhaust temperature downstream of the filter is exceeded, regeneration of the filter is inhibited by either setting the air ratio to a setpoint within a range of more than 1, especially of 1.2-1.3, or temporarily cutting the filter out of the exhaust stream by passing the exhaust through a filter bypass passage. A lambda probe is used to sense the oxygen content of the exhaust gas, and temperature sensors are used to sense the actual exhaust temperatures in the exhaust pipe upstream and downstream of the filter. The measured temperatures and setpoints are applied as inputs to a control unit which provides control signals for the throttle device and the check valve in the bypass passage. 3 figs.

3308 Alternative Fuels

Refer also to citation(s) 17884, 18134, 18801

18809 (DOE/CE--92013169) **Second interim report of the Interagency Commission on Alternative Motor Fuels.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Sep 1991. 86p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013169. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes progress the commission and government agencies have made in implementing the provisions of the Alternative Motor Fuels Act of 1988, assessing the role of alternative motor fuels in the US transportation sector, and developing policies to promote the use of alternative fuels. The alternative motor-fuels policies proposed in the National Energy Strategy (NES) are described and shows how they compose an effective long-term plan to encourage the widespread use of alternative motor fuels. The progress to date of the Department of Energy (DOE) and other agencies in implementing the programs required by the AMFA is reported. A detailed scenario of future alternative-fuel use that displaces 2.5 million barrels per day (MMBD) of petroleum and a feasible path of vehicle production and fuel supply leading to that goal is described. An analytical tool for exploring and quantifying the energy market impacts of alternative fuels, the Alternative Fuels Trade Model (AFTM), is described. The AFTM provides a means of investigating the impacts of alternative fuels in interrelated world energy markets for petroleum and natural gas. Several major initiatives have recently been enacted that have important ramifications for alternative-fuels policy. The Clean Air Act Amendments of 1990 contain provisions mandating the use of nonpetroleum oxygenates in reformulated gasoline. Other provisions for much more stringent emissions standards may affect the ability of manufacturers to make and sell conventional-fuel vehicles or, at the very least, affect their cost-effectiveness in comparison to cleaner alternative-fuel vehicles (AFV's). Finally, the key areas in which technological advances could substantially improve the competitiveness of AFV technologies in the marketplace are reviewed.

35 ARMS CONTROL

18810 (UCRL-JC--109224) **Further limitations on nuclear testing.** Brown, P.S. Lawrence Livermore National Lab., CA (United States). Nov 1991. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9111213--1: 10. core group meeting on the programme for promoting nuclear non-proliferation, Princeton, NJ (United States), 8-10 Nov 1991). Order Number DE92011529. Source: OSTI; NTIS; INIS; GPO Dep.

This document addresses a number of subjects related to further constraints on nuclear testing, briefly discussing each of the following topics: the current political situation, the kinds of steps that might next be taken in test limitations and the impacts of further testing limits, the need for a test ban readiness program, some issues related to verification, and the possibility of confidence building measures as alternative, or near-term, steps to further test limitations.

3501 Policy, Negotiations, and Legislation

18811 (INIS-mf--13165) **New trends in science and technology implications for international peace and security.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Mar 1991 15p. Order Number DE92627131. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

In December 1988, the General Assembly requested the Secretary-General to follow future scientific and technological developments, especially those with potential military applications, and to evaluate their impact on international security. In resolution 43/77 A it also requested the Secretary-General to report to it at its forty-fifth session. The broad fields in which scientific and technological developments are taking place were identified as: information technology, biotechnology, materials technology, nuclear technology and space technology. These assessments were discussed by a wider group of experts at a high-level conference on "New trends in science and technology: implications for international peace and security", held in April 1990 in the city of Sendai, Japan. The Conference, which was attended by nearly 100 participants from over 20 countries, addressed issues of technological change and global security, new technologies and the search for security in the post-cold-war era, and national policy-making and international diplomacy in an era of rapid technological change. General approaches to technology assessment and technology trends in selected areas were also discussed. The positions taken by Member States on the subject of establishing a mechanism for technology assessment were also taken into account. The highlights of the report are summarized.

18812 (INIS-mf–13166) **Towards a nuclear-test ban.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Apr 1991 34p. Order Number DE92627132. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

In 1986 and again in 1987 the General Assembly adopted resolutions by which it called on States conducting nuclear-test explosions to notify the Secretary-General, within one week of each explosion, of the time, place, yield and site characteristics of the test and also invited all other States to provide any such data on nuclear explosions that they might have. Over the years, in the Conference on Disarmament, members of the Group of 21 (mostly neutral and non-aligned countries) have continued to attach the utmost importance to the urgent conclusion of a comprehensive test-ban treaty as a significant contribution to the aim of ending the qualitative refinement of nuclear weapons and the development of new types of such weapons as well as of reversing the nuclear-arms race and achieving nuclear disarmament. In 1995 a conference will be convened to decide whether the non-proliferation Treaty will continue in force indefinitely, or will be extended for an additional fixed period or periods. Many States support the view that a comprehensive test ban would be a significant contribution to the non-proliferation of nuclear weapons; and some believe that, without a cessation of nuclear testing, it may not be possible to extend the NPT well beyond 1995. Other States, however, are of the opinion that the NPT, independently, offers benefits for the security of all States and, by its extension, will continue to do so.

18813 (INIS-mf–13167) **Towards a nuclear-weapon-free zone in the Middle East: Summary of a United Nations study.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jun 1991 29p. Order Number DE92627133. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

Every year since 1974 the General Assembly adopted a resolution on the subject "Establishment of a nuclear-weapon-free zone in the Middle East". By that resolution, the General Assembly requested the Secretary-General to undertake a study on effective and verifiable measures which would facilitate the establishment of a nuclear-weapon-free zone in the Middle East, taking into account the circumstances and characteristics of the Middle East, as well as the views and the suggestions of the parties of the region, and to submit this study to the General Assembly. The study was carried out between July 1989 and August 1990. The study discusses a number of steps and measures that could ease the process leading to the establishment of a nuclear-weapon-free zone in the Middle East. Those measures could be undertaken independently or in conjunction with each other, as well as by individual States or jointly by several, and also on a reciprocal basis; each of them would move the States concerned closer to their ultimate objective - the establishment of a zone free of nuclear weapons.

18814 (INIS-mf–13168) **United Nations regional disarmament workshop for Asia and the Pacific. Disarmament fellowship, training and advisory services programme.** Disarmament. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Oct 1991 267p. (CONF-9101138–: United Nations regional disarmament workshop for Asia and the Pacific, Bandung (Indonesia), 28 Jan 1991). Order Number DE92627134. Source: OSTI; NTIS (US Sales Only); INIS.

The main objectives of the Workshop have been to promote a better understanding and awareness of the current disarmament negotiations and issues, particularly those of common concern to the region, and to facilitate conflict resolution, strengthen disarmament efforts and enhance regional security. 19 papers were presented. The Workshop (a) considered the concepts of peace and security in the Asia-Pacific context; (b) assessed the global efforts to achieve a comprehensive ban on chemical weapons and to strengthen the non-proliferation regimes of nuclear weapons and other weapons of mass destruction; (c) reviewed regional disarmament efforts in general and examined in detail efforts and proposals from the South Asian, South-East Asian and Pacific perspectives; and (d) discussed, through various case studies, conflict resolution in the Asia-Pacific region. The discussions which followed the presentations could be grouped under the following headings: Perception of the role to be played by the major Powers in Asia and the Pacific; approach to peace and security; NPT; PTBT; the South Pacific Nuclear Free Zone Treaty (Treaty of Rarotonga) and the proposal to establish a nuclear-weapon-free zone in South-East Asia (SEANWFZ).

3502 Proliferation

18815 (LA-UR–92-889) **Superpower nuclear minimalism?.** Graben, E.K. Los Alamos National Lab., NM (United States). [1992]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9203134–1: International Studies Association annual conference, Atlanta, GA (United States), 31 Mar - 3 apr 1992). Order Number DE92011268. Source: OSTI; NTIS; GPO Dep.

During the Cold War, the United States and the Soviet Union competed in building weapons – now it seems like America and Russia are competing to get rid of them the fastest. The lengthy process of formal arms control has been replaced by exchanges of unilateral force reductions and proposals for reciprocal reductions not necessarily codified by treaty. Should superpower nuclear strategies change along with force postures? President Bush has yet to make a formal pronouncement on post-Cold War American nuclear strategy, and it is uncertain if the Soviet/Russian doctrine of reasonable sufficiency formulated in the Gorbachev era actually heralds a change in strategy. Some of the provisions in the most recent round of unilateral proposals put forth by Presidents Bush and Yeltsin in January 1992 are compatible with a change in strategy. Whether such a change has actually occurred remains to be seen. With the end of the Cold War and the breakup of the Soviet Union, the strategic environment has fundamentally changed, so it would seem logical to reexamine strategy as well. There are two main schools of nuclear strategic thought: a maximalist school, mutual assured destruction (MAD) which emphasizes counterforce superiority and nuclear war- fighting capability, and a MAD-plus school, which emphasizes survivability of an assured destruction capability along with the ability to deliver small, limited nuclear attacks in the event that conflict occurs. The MAD-plus strategy is based on an attempt to conventionalize nuclear weapons which is unrealistic.

3503 Verification

18816 (INIS-mf–13164) **The role of the United Nations in the field of verification: Summary of a United Nations study.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jan 1991 27p. Order Number DE92627130. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

By resolution 43/81 B of 7 December 1988, the General Assembly requested the Secretary General to undertake, with the assistance of a group of qualified governmental experts, an in-depth study of the role of the United Nations in the field of verification. In August 1990, the Secretary-General transmitted to the General Assembly the unanimously approved report of the experts. The report is structured in six chapters and contains a bibliographic appendix on technical aspects of verification. The Introduction provides a brief historical background on the development of the question of verification in the United Nations context, culminating with the adoption by the General Assembly of resolution 43/81 B, which requested the study. Chapters II and III address the definition and functions of verification and the various approaches, methods, procedures and techniques used in the process of verification. Chapters IV and V examine the existing activities of the United Nations in the field of verification, possibilities for improvements in those activities as well as possible additional activities, while addressing the organizational, technical, legal, operational and financial implications of each of the possibilities discussed. Chapter VI presents the conclusions and recommendations of the Group.

36 MATERIALS

3601 Metals and Alloys

Refer also to citation(s) 17736, 17809, 17914, 17964, 18067, 18132, 18239, 18289, 18319, 18325, 18326, 18327, 18328, 18329, 18330, 18331, 18332, 18333, 18334, 18335, 18336, 18337, 18338, 18339, 18363, 18366, 18367, 18368, 18397, 18404, 18405, 18406, 18506, 18509, 18517, 18520, 18521, 18522, 18568, 18758, 18921, 18954, 18965, 18966, 19035, 19087, 19088, 19098, 19108, 19117, 19119, 19138, 19139, 19267, 19358, 19366, 19825, 20296, 20306, 20320, 20433, 20458, 20600

18817 (AECL–8852) **Formation, growth and decomposition of precipitates in Zircaloy-2 and -4.** Griffiths, M.; Gilbert, R.W.; Cheadle, B.A. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1985. 22p. Order Number DE92625623. Source: OSTI; NTIS (US Sales Only); INIS.

The intermetallic precipitates in Zircaloy-2 are mainly $Zr(Cr,Fe)_2$ and $Zr_2(Ni,Fe)$. Zircaloy-4 only has the former unless the nickel impurity level is high. These precipitates are based on the hcp $ZrCr_2$ Laves phase and bct Zr_2Ni Zintl phase with Fe substituting for Cr and Ni in proportions that depend on the alloy composition. Their structure, composition and morphology are determined by the metallurgical history and can be changed by n eutron irradiation. $Zr(Cr,Fe)_2$ precipitates irradiated at 580 K are depleted in Fe and to a lesser extent Cr. Depletion below the stoichiometric value is coincident with transformation from a crystalline to an amorphous structure. The transformation starts at the surface of the precipitate and advances inwards with increasing fluence. No structural change has been observed in $Zr_2(Ni,Fe)$ precipitates irradiated at 580 or 675 K. At irradiation temperatures $\geq$ 675 K there is solute depletion and dissolution of $Zr(Cr,Fe)_2$ precipitates but no crystalline-amorphous transformation has been observed. There is a distinct observable change in precipitate morphology with the formation of Fe rich precipitates at grain boundaries and in the matrix. Both the $Zr(Cr,Fe)_2$ and $Zr_2(Ni,Fe)$ precipitates irradiated at 350 K undergo complete amorphous transformation although solute depletion has not been observed.

18818 (AECL–9952) **Localized corrosion of alloys C-276 and 625 in aerated sodium chloride solutions at 25 to 200 degrees C.** Postlethwaite, J. (Regina Univ., SK (Canada). Dept. of Chemistry). Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Dec 1991. 43p. Order Number DE92625597. Source: OSTI; NTIS (US Sales Only); INIS.

Two molybdenum-bearing nickel alloys, Alloy C-276 and Alloy 625, were previously identified for consideration as candidate container materials for the Canadian Nuclear Fuel Waste Management Program. Because of the paucity of data for the localized corrosion behaviour of these passive alloys under conditions that may be experienced in a disposal vault, this project was undertaken to study the crevice and pitting corrosion of Alloys C-276 and 625 in chloride solutions at elevated temperatures. Electrochemical and immersion tests have been conducted in neutral sodium chloride solutions (0.1 wt% to saturated) at 25 to 200 degrees C, in an attempt to identify the conditions under which localized corrosion occurs and to relate the actual corrosion behaviour to that expected on the basis of electrochemical studies. Cyclic polarization studies showed that the passivation breakdown potentials move rapidly to more active values with increasing temperatures. Above 100 degrees C the resistance to localized corrosion is greatly reduced. The results of the immersion tests are presented in the form of T versus (C1-) diagrams. These susceptibility diagrams suggest that there is a limiting crevice-corrosion temperature for each alloy in aerated, neutral sodium chloride solutions. Below this temperature corrosion does not occur, regardless of the chloride concentration. The values of the limiting crevice-corrosion temperatures were in the range 100 to 125 degrees C for Alloy C-276 and 100 to 115 degrees C for Alloy 625. Such values suggest that saturation of the chloride solutions by surface boiling could occur without the initiation of localized corrosion. These electrochemical results indicate that a large safety margin for susceptibility to localized corrosion might be found below 100 degrees C.

18819 (ANL/CP–74638) **Rolling-contact and wear resistance of hard coatings on bearing-steel substrates.** Erdemir, A. Argonne National Lab., IL (United States). Feb 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920439–6: International conference on metallurgical coatings and thin films, San Diego, CA (United States), 6-10 Apr 1992). Order Number DE92011834. Source: OSTI; NTIS; GPO Dep.

Ever-increasing needs for high-performance ball- and roller-bearing components that can endure extreme applications have led to a growing interest in hard coatings for improved fatigue life and wear resistance. In particular, hard TiN and TiC coatings and, quite recently, diamond like carbon films have attracted much attention from manufacturers that produce bearing systems for both rolling- and sliding-contact applications. This paper presents an overview that highlights recent incremental progress in achieving improved fatigue and wear resistance in bearing steels through the use of hard coatings. Effects of coating adhesion, thickness, and morphology on fatigue and wear resistance of hard coatings are discussed in detail. Specific references are made to a few mechanistic models that correlate coating thickness and adhesion to improved fatigue life and wear resistance.

18820 (CONF-9105202–, pp. 9, Paper 9) **First principles simulations of metallic alloys and liquids.** Davenport, J.W. (Brookhaven National Lab., Upton, NY (United States)); Fernando, G.W.; Qian, G.-X.; Watson, R.E.; Weinert, M. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC02-76CH00016. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

In recent years it has become possible to calculate the structural and thermodynamic properties of materials from first principles. The words first principles refer to the fact that there are not adjustable parameters in these theories. The calculator need only specify the atomic constituents - the rest is handled by the computer. In this sense the calculations are unbiased and can be used to search for new materials with interesting new properties. Work at Brookhaven has focused on metallic systems because of their nearly universal use as structural materials. The search for new alloys by traditional techniques (based largely on trial and error) has become much too costly. Being both accurate and cheaper, guidance from computational and analytical theory is needed to narrow the search. In addition, it is important to extend these calculations to nonzero temperature - including the liquid phase. This is so because liquids form an essential part of the phase diagram and a theory which aims to calculate phase diagrams should be able to handle liquids. This also gives a theoretical maximum temperature (operation certainly can't exceed the melting temperature). In addition, processing of new materials often involves quenching from the melt or annealing at high temperature.

18821 (CONF-911003–25) **Quasi-static intergranular cracking in a Cu-Sn alloy: An analog of stress relief cracking of steels.** Barrera, E.V.; Menyhard, M.; Bika, D.; Rothman, B.; McMahon, C.J. Jr. Pennsylvania Univ., Philadelphia, PA (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-87ER45290. From Fall meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals; Cincinnati, OH (United States); 20-24 Oct 1991. Order Number DE92011646. Source: OSTI; NTIS; GPO Dep.

Intergranular cracking in a laboratory-made Cu-8wt%Sn alloy at 265 to 300°C in vacuum was studied in order to explore the hypothesis that this could serve as an analog to the brittle mode of stress-relief cracking in steels and to test the mechanism proposed earlier to explain that phenomenon. This mechanism involves the stress-induced intergranular penetration along grain boundaries of a surface-adsorbed embrittling element. Sulfur is the active element in this regard in steels, and tin was envisioned as playing the same role in Cu-Sn alloys. Auger spectroscopy was used to confirm earlier reports of the surface activity of tin and to determine the segregation kinetics in the present polycrystals; no other elements were found to segregate to surfaces to any significant degree in the present alloy. Crack growth measurements showed that intergranular cracking occurs in an intermittent manner at an average rate on the order of 0.1 μm/sec over a range of crack length. Crack initiation was found to be remarkably sensitive to the stress intensity, implying the existence of a threshold. The fracture appearance in the regions of slow crack growth was similar to that observed in steels undergoing stress-relief cracking at 500–600°C. It was concluded that the quasi-static intergranular cracking in the steels and in the Cu-Sn alloy represent two aspects of the same generic phenomenon and that the proposed mechanism of stress-induced intergranular impurity penetration is valid. It is believed that liquid-and solid-metal embrittlement are closely related to the type of intergranular cracking described here.

18822 (CONF-911202–71) **Diffusion-controlled decohesion using a Cu-Sn alloy as a model system.** Bika, D.; McMahon, C.J. Jr. Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Materials Science and Engineering. [1991]. 6p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-87ER45290. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92011645. Source: OSTI; NTIS; GPO Dep.

This research deals with a mode of brittle intergranular fracture in which a surface adsorbed embrittling element is driven into a grain boundary as a result of the application of a tensile stress across the boundary. A Cu-8%Sn alloy has been employed to explore this phenomenon, since tin is a surface-active element, and this alloy is known to suffer intergranular weakness at elevated temperatures. Intergranular cracking occurred by brittle, discontinuous crack advance at 265°C in vacuum with an average rate of 0.1μm/sec. This behavior is analogous to sulfur-induced stress-relief cracking in steels and several cases of liquid-metal embrittlement, suggesting that this phenomenon has a generic nature.

18823 (CONF-911202–74) **Compositional disorder, magnetism, and their interplay in metallic alloys.** Johnson, D.D. (Sandia National Labs., Albuquerque, NM (United States)); Staunton, J.B.; Pinski, F.J.; Gyorffy, B.L.; Stocks, G.M. Oak Ridge National Lab., TN (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92011671. Source: OSTI; NTIS; GPO Dep.

Chemical disorder leads to variety of intriguing phenomena in alloys which have yet to be fully understood, particularly those phenomena occuring when chemical and magnetic effects interplay with one another. For example, magnetic order gives rise to chemical ordering in alloys, as in Ni-rich NiFe alloys. Two examples of the interplay of chemical disorder and magnetism will be discussed. Our recently developed ab-initio Landau (mean-field) theory for calculations the chemical-chemical, magneto-chemical, and magnetic-magnetic correlation functions in substitutional random alloys is used to describe electronic/magnetic mechanisms (e.g. in FeV) which give rise to the chemical short-range order as determined by neutron, X-ray, or electron diffuse scattering intensities. New developments within this approach that account for charge rearrangement effects will be mentioned. These calculations are performed within the multiple-scattering framework, developed by Korringa, Kohn, and Rostoker (KKR), combined with the coherent potential approximation (CPA) to describe the disorder. This approach allows a first-principles description of the electronic structure of the high-temperature, chemically disordered state and its instability to ordering at low temperatures. This method provides not only a direct comparison of diffuse scattering data with theory but a means to understand more fully the underlying mechanisms which drive chemical and/or magnetic ordering.

18824 (CONF-920305–8) **Low-temperature neutron irradiation.** Kerchner, H.R. (Oak Ridge National Lab., TN (United States)); Klabunde, C.E.; Coltman, R.R. Oak Ridge National Lab., TN (United States). Mar 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Minerals, Metals, and Materials Society (TMS) annual meeting and exhibition; San Diego, CA (United States); 1-5 Mar 1992. Order Number DE92011037. Source: OSTI; NTIS; GPO Dep.

The use of low (cryogenic) temperatures to immobilize radiation-produced defects provides the capability to accumulate high defect concentrations having distributions greatly different from what is produced during ambient or high temperature irradiations. In addition to modifications of the low-temperature materials properties, a low-temperature irradiation followed by warmup can modify materials properties over a wide range of temperatures. As examples, irradiation-induced amorphization of NiTi, the release of stored energy in Cu, and the radiation-damage contribution to the superconducting critical current of Nb are described. The presently operating, low-temperature irradiation facilities at the Munich Research Reactor in Germany and the Kyoto University Reactor in Japan, are compared with facilities used at Oak Ridge National Laboratory.

18825 (CONF-920631–16) **Assessment of an improved multiaxial strength theory based on creep-rupture data for type 316 stainless steel.** Huddleston, R.L. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Society of Mechanical Engineers pressure vessel and piping conference; New Orleans, LA (United States); 21-25 Jun 1992. Order Number DE92010431. Source: OSTI; NTIS; GPO Dep.

A new multiaxial strength theory incorporating three independent stress parameters was developed and reported by the author in 1984. It was formally incorporated into ASME Code Case N47-29 in 1990. In the earlier paper, the new model was shown to provide significantly more accurate stress-rupture life predictions, than the classical theories of von Mises, Tresca, and Rankine, for the type 304 stainless steel tested at 593°C under different biaxial stress states. Further assessments for other alloys are showing similar results. The current paper provides additional results for type 316 stainless steel specimens tested at 600°C under tension-tension and tension-compression stress states and shows 2–3 orders of magnitude reduction in the scatter in predicted versus observed lives. A key feature of the new theory, which incorporates the maximum deviatoric stress, the first invariant of the stress tensor, and the second invariant of the deviatoric stress tensor, is its ability to distinguish between life under tensile versus compressive stress states.

18826 (DOE/ER/13566–5) **Inelastic deformation and damage at high temperature: Progress report, April 1, 1991–March 31, 1992.** Krempl, E. Rensselaer Polytechnic Inst., Troy, NY (United States). Mechanics of Materials Lab. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13566. Order Number DE92012241. Source: OSTI; NTIS; GPO Dep.

Combined experimental and theoretical investigations into the inelastic deformation and damage behavior of engineering alloys at elevated temperatures are being pursued. The analysis of previously performed strain rate change and relaxation tests on modified 9Cr-1Mo steel showed the need for inclusion of a recovery of state term in the growth laws for the state variables of the viscoplasticity theory based on overstress (VBO). Recovery of state terms were introduced and the experimental results were satisfactorily simulated. The finite deformation theory of VBO has been developed further to include a convected derivative rationale for the choice of the objective stress rate. The reversing direct current voltage drop measurements during low cycle fatigue at elevated temperature were improved. A passive filter bank and new positioning devices for the coils were installed. Tests at 650°C and lasting several days showed excessive, uncontrollable temperature changes. It was decided to drop the test temperature to 538°C which is close to the operating temperature of Type 304 Stainless Steel. The temperature fluctuations in torsion tests were within ±3°C which was considered satisfactory. Testing will continue at 538°C.

18827 (DOE/ER/45182–6) **Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Final progress report, 1 March 1988–31 August 1991.** Carpenter, S.H. Denver Univ., CO (United States). Dept. of Physics. [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER45182. Order Number DE92011907. Source: OSTI; NTIS; GPO Dep.

This report is the "FINAL PROGRESS REPORT" for the research program "Investigation of Fracture Toughness and Fracture Mechanisms using Acoustic Emission Measurements." The time period covered by this report is from 1 March 1988 through August 1991. The research program consisted of three separate but closely related investigations: (1) An Investigation of the Acoustic Emission Generated during the Deformation and Fracture of Premium Grade 4340 Steel as a function of Mechanical Properties. (2) An Investigation of the Acoustic Emission Generated during the Deformation and Fracture of Ti-641-4V Alloys as a Function of Microstructure. (3) An Investigation of the Acoustic Emission Generated from Second Phase Particles in Aluminum-Silicon Alloys as a Function of Second Phase Particle Size and Density. A synopsis of each of the individual investigations including pertinent data and meaningful results will be given in the report. A listing of graduate student involvement, publications and presentations will also be provided.

18828 (DOE/ER/45332–T1) **Preparation and characterization of superlattices: Progress report, March 15, 1991–March 14, 1992.** Schuller, I.K. California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics. [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER45332. Order Number DE92012572. Source: OSTI; NTIS; GPO Dep.

During this last year we were involved in a number of studies geared towards understanding the relationship between interfacial disorder and X-ray diffraction from superlattices. In addition, we have performed a number of physical properties studies in order to relate structure to physical properties. These studies include magnetism and superconducting studies in a variety of different thin film systems. A major development was the implementation of a structural refinement program capable of determining the important structural parameters in superlattices and thin films. This program is being supplied to many research groups for the study of related problems. We are currently devoted to detailed, comparative studies of magnetic samples prepared by Molecular Beam Epitaxy and sputtering. The unique facilities available to us not only allow preparing samples by the two different methods but also are capable of determining interfacial structure using in-situ characterization techniques such as Reflection High Energy Electron Diffraction (RHEED), Low Energy Electron Diffraction (LEED) and Auger Electron Spectroscopy (AES). We have developed a data acquisition system capable of acquiring electron diffraction in real time during growth. Part of the work done here is a good example of a collaboration between a University (UCSD), a national lab (ANL) and industrial organizations (Amoco, IBM).

18829 (DOE/ER/45403–3) **Atomic structures and compositions of internal interfaces: Progress report, September 1, 1991–August 31, 1992.** Seidman, D.N. (Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering); Merkle, K.L. Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering. Mar 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER45403. Order Number DE92012136. Source: OSTI; NTIS; GPO Dep.

This research program addresses fundamental questions concerning the relationships between atomic structures and chemical compositions of metal/ceramic heterophase interfaces. The chemical composition profile across a Cu/MgO {111}-type heterophase interface, produced by the internal oxidation of a Cu(Mg) single phase alloy, is measured via atom-probe field-ion microscopy with a spatial resolution of 0.121 nm; this resolution is equal to the interplanar space of the {222} MgO planes. In particular, we demonstrate for the first time that the bonding across a Cu/MgO {111}-type heterophase interface, along a <111> direction common to both the Cu matrix and an MgO precipitate, has the sequence Cu|O|Mg··· and not Cu|Mg|O···; this result is achieved without any deconvolution of the experimental data. Before determining this chemical sequence it was established, via high resolution electron microscopy, that the morphology of an MgO precipitate in a Cu matrix is an octahedron faceted on {111} planes with a cube-on-cube relationship between a precipitate and the matrix. First results are also presented for the Ni/Cr_2O_4 interface; for this system selected area atom probe microscopy was used to analyze this interface; Cr_2O_4 precipitates are located in a field-ion microscope tip and a precipitate is brought into the tip region via a highly controlled electropolishing technique.

18830 (DOE/ER/45433–1) **Effect of fracture surface interference on shear crack growth: Progress report, September 1, 1990–April 30, 1992.** Gross, T.S. (New Hampshire Univ., Durham, NH (United States). Dept. of Mechanical Engineerng); Watt, D.W.; Mendelsohn, D.A. New Hampshire Univ., Durham, NH (United States). Dept. of Mechanical Engineerng. Feb 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45433. Order Number DE92011431. Source: OSTI; NTIS; GPO Dep.

A joint analytical-experiment program to investigate the effect of fracture surface interference on shear modes of crack growth is progressing satisfactorily. A general two-dimensional, boundary element model has been formulated by the group at Ohio State University that is capable of calculating the effective Mode I and Mode II stress intensity factors for flat or curved cracks with small scale yielding. The model can calculate K_I and K_{II} for an arbitrary constitutive law for displacement of the crack faces. The constitutive law proposed in our earlier work is being used in the new boundary element model. The experimental portion of the effort at UNH was to use an as-yet undeveloped electro-optic holographic interferometry (EOH) system to measure the crack face displacement field while the crack is loaded in shear. The algorithms for obtaining the interferograms have been developed, the testing machine modifications necessary for interferometric measurements are complete, and interferograms of specimens under load have been obtained. Techniques for digitizing the fracture surface profile have been developed and preliminary numerical experiments have been conducted to determine the ΔK dependence of fracture asperity interference on an actual crack.

18831 (EGG-M–91135) **Rate of coal devolatilization in iron and steelmaking processes.** Sampaio, R.S. (Carnegie Mellon Univ., Pittsburgh, PA (United States). Center for Iron and Steel Making Research); Rio Doce, C.V. do; Fruehan, R.J.; Ozturk, B. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-89ID12847. (CONF-910431–2: Ironmaking and steel making conference, Washington, DC (United States), 14-17 Apr 1991). Order Number DE92011140. Source: OSTI; NTIS; GPO Dep.

The devolatilization of coal particles under ironmaking and steelmaking conditions was studied. A new experimental technique was developed to measure the rates of devolatilization. A unique method was used to prepare coal particles based on thick coal bands rich in a given maceral group. Experiments with these single particles gave good reproducibility. The rates of devolatilization for all coal types from low to high rank coals were measured in the gaseous atmosphere and within the slag phase. Real time x-ray images were taken for high volatile, low volatile and anthracite coals devolatilizing in a molten smelting slag. The rate in terms of percentage devolatilization were relatively independent of coal type and a small function of furnace temperature at high heating rates and temperatures studied. The rates depended on particle size and heating rates. The results were consistent with internal transport controlled processes primarily heat transfer. Furthermore the rates were the same in the gas and slag phase which is consistent with heat transfer control.

18832 (ENEA-RT-INN–90-41) **Positron annihilation study on age-hardened Al alloys.** Bartolomei, P.; Biasini, M.; Valli, M.;

Abis, S.; Dupasquier, A.; Somoza, A. ENEA, Bologna (Italy). Centro Ricerche Energia 'E. Clementel' - Area Energia e Innovazione; Politecnico di Milano, Milan (Italy). Ist. di Fisica. Apr 1991. 18p. (RT/INN–90-41). Order Number DE92506289. Source: OSTI; NTIS (US Sales Only); INIS.

Positron annihilation measurements are used to characterize the precipitation phenomena during the age hardening process of the 7012, 2219 and 2014 Al alloys. The response of the positron annihilation parameters during the ageing process can be explained depending on the composition of the alloys and is used to derive quantitative information on the kinetic of the transformation from coherent Guinier-Preston zones to semicoherent precipitates.

18833 (ETDE-IT–92-21) **Aeronautic lightweight alloy crack propagation and arrest: Numerical-experimental simulation.** Marchetti, M.; Milella, P.P.; Pini, A.; Torelli, A. ENEA, Rome (Italy). Direzione Sicurezza Nazionale e Protezione Sanitaria; Rome Univ. (Italy). 1991. 14p. (In Italian). (CONF-9106351–1: 7. convegno nazionale Gruppo Italiano Frattura (IGF), Florence (Italy), 13-14 Jun 1991). Order Number DE92506238. Source: OSTI; NTIS (US Sales Only).

This paper describes experimental and numerical tests to determine the feasibility of the use of the wedge loading technique in performing crack arrest fracture toughness testing on typical aeronautic alloys such as 7075-T6 and 2024-T351. The final aim of this work would be to check if a crack which has begun to propagate can be stopped without putting the structural integrity of the entire section at risk. The experimental tests, which followed the ASTM E 1221-88 guidelines, also gave importance to the assessment of temperature effects on crack propagation. Temperatures, made to vary from - 80 degrees C to room temperature, indicated a significant independence between arrest fracture toughness and temperature. Considerable difficulties were encountered in crack initiation in the 2024-T351 aluminium alloy. Wedge loaded tapered crack arrest (WLTCA) numerical simulations were performed with the use of the finite element based SPACCA code developed, in part, by ENEA (Italian National Agency for New Technologies, Energy and Environment).

18834 (ETDE-IT–92-25) **Co-Fe based amorphous alloy corrosion resistance: Effects of composition and heat treatment.** Angelini, E.; Antonione, C.; Baricco, M.; Rosalbino, F.; Zucchi, F. Politecnico di Torino, Turin (Italy). Dept. of Material Sciences and Chemical Engineering; Turin Univ. (Italy); Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin (Italy); Ferrara Univ. (Italy). 1990. 11p. (In Italian). (CONF-9009489–1: 23. convegno nazionale AIM, Ancona (Italy), 25-27 Sep 1990). Order Number DE92506241. Source: OSTI; NTIS (US Sales Only).

This paper examines the influence of composition and heat treatment on the corrosion resistance, in a 1.5 pH solution of Na_2SO_4 0.05M + H_2SO_4 0.05M, of series of iron based amorphous alloys with increasing cobalt content, i.e., $Fe_{80-x}Co_xB_{10}Si_{10}$ with values of $x = 0,30,80$. The heat treatments were carried out in an argon atmosphere at increasing durations (30, 60, 120 and 240 min) and temperatures (350, 400, 450, and 500 degrees C). Independently of the type of heat treatment, it was observed that the corrosion resistance increases with increasing cobalt concentration. In comparing samples having the same composition, corrosion resistance deteriorated with increasing heat treatment duration times and temperatures.

18835 (INIS-mf–13159) **Degradation of nuclear power plant materials by the working environment.** Ceskoslovenska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989 162p. (In Czech, Slovak). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The proceedings contain 27 contributions, all of which have been inputted in INIS. They deal with the radiation embrittlement of steels, with corrosion problems of reactor pressure vessels, steam generators, turbines and other reactor components, with radiation degradation and thermal degradation of cables, thermocouples and bolts, with problems of blowdown sampling, and with reactor component lifetime calculations and feasibility assessment of its extension. (M.D.). 52 figs., 13 tabs., 117 refs.

18836 (INIS-mf–13159, pp. 24-28) **The microstructure of reactor pressure vessel steels.** Kocik, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Keilova, E. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Changes in the microstructure are due to the neutron irradiation. Specimens of the base material and of the filler metal of 15Kh2MFA and 15Kh2NMFA steels were investigated in the unirradiated and irradiated states. The structure of the unirradiated specimens was examined by optical microscopy, the dislocation structure of the material was observed with an electron microscope. The study was completed with measurements of angular correlation positron annihilation spectra, enabling defects below the resolving power of the microscope to be detected. Characteristic of the microstructure of the two steels is alternation of the slat and cell structures. Carbides $M_{23}C_6$ and M_7C_3 were identified; they are only precipitated along the grain boundaries. The following defects were observed in the irradiated specimens: black points, small dislocation loops, spatial vacancy clusters, stabilized C atoms, and fine precipitate particles. The increase in density and decrease in the fine particle size may be due to the decomposition and reprecipitation of VC particles during irradiation. (M.D.). 1 tab., 6 refs.

18837 (INIS-mf–13159, pp. 43-47) **Determination of changes in the hydrogen content of pressure vessel steel in dependence on the austenitic lining overlaying technology.** Kovarik, R. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)); Koutsky, J.; Splichal, K. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The susceptibility to hydrogenation of the heat affected zone of the pressure vessel base material was examined experimentally. This susceptibility is primarily determined by the steel strength. The crack formation and propagation depend on pressure and on the hydrogen content. The penetration of hydrogen is not prevented by the austenitic overlay, only the penetration rate is reduced. Plates of Cr-Mo-V and Cr-Ni-Mo-V steels were used, treated by the same procedure as applied to the manufacture of the pressure vessels. The heat affected zone is more prone to hydrogenation than the base material. A similar dependence of ductility decrease on the hydrogen content was found for the two steels; the ductility dropped appreciably starting from hydrogen contents of 2.5 to 3 ppm. At hydrogen contents above 2 ppm, the fracture changed from plastic fracture to brittle cleavage. Examination of the microstructure showed that the heat affected zone includes many defects which can act as hydrogen capture sites. The reason for this lies in changes in the structure due to the thermal deformation process during overlaying. (M.D.). 3 figs., 1 tab., 7 refs.

18838 (INIS-mf–13159, pp. 1-8) **Approaches to reducing the radiation embrittlement of reactor pressure vessel steels.** Vacek, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Havel, R.; Novosad, P. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Reliability of the reactor pressure vessel is determined by the quality of the material and by its mechanical and metallurgical properties. Degradation of the material is primarily caused by neutron irradiation. The factors affecting most the susceptibility of the material to failure include the neutron fluence, the irradiation temperature and the copper content of the steel. Reduction of the fluence of neutrons impinging on the vessel wall is achieved by using shielding assemblies, by increasing the water gap between the fuel and the wall, or by inserting new fuel in the centre of the reactor core and by employing burnable poisons. Increasing the vessel wall temperature is impracticable for operational reasons. The copper content of the material is limited to 0.1% or 0.06%. The manufacture technologies ensure a high toughness and a low transition temperature. If the pressure vessel embrittlement is too high, regeneration annealing is the only way to restore its toughness. (M.D.). 1 tab., 1 fig., 8 refs.

18839 (INIS-mf--13159, pp. 29-36) **The effects of the manufacture technology and of thermal regimes on the degradation of properties of steel for 1000 MW nuclear power plant units.** Teindl, T. (Vitkovice, Ostrava (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

In forged materials, higher material parameters are attained due to the higher degree of forming throughout the bulk. For plates it is imperative that their properties approach as closely as possible those of forgings. The thicker the plate, the poorer the formability throughout the bulk and the higher the occurrence of inhomogeneities and the anisotropy of properties. The object of study was the 10GN2MFA steel, designed for WWER-1000 steam generators and pressurizers. The plasticity of the steel decreases during repeated heating at 600-650 degC. High-temperature heating brings about growth of the austenitic grain and formation of metastable structures during cooling. The decrease in strength and in plasticity is explained as being due to the softening of the boundaries of the austenitic grain and to the dispersion strengthening of the inner grain bulk. For upgrading the plasticity properties, cooling from 1200 degC into water or in a furnace at a rate of 50 degC/h was tested, or isothermal arrest for a time not exceeding 50 hours was applied. The effect of thermal aging on the brittle fracture of the steel was also studied. The test material was heat treated and subjected to impact bending tests with a sharp notch. The steel was found little prone to aging. (M.D.). 2 figs., 5 refs.

18840 (INIS-mf--13159, pp. 37-42) **Effect of operating conditions on the properties of 14Kh17N2 steel.** Brynda, J. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi); Cerny, V. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Tests gave evidence that bar-shaped half-finished products made of the 14Kh17N2 steel possess a very low notch toughness in the transversal direction, particularly at high delta-ferrite contents, and no improvement can be achieved by additional heat treatment. A high susceptibility to radiation embrittlement was also observed. High radiation hardening values were attained; for the most exposed parts the hardness increased to a double. (M.D.). 4 figs., 1 tab., 2 refs.

18841 (INIS-mf--13159, pp. 53-57) **Addressing problems of operation failure of thermocouples installed at WWER-440 nuclear reactors.** Cizek, Z. (Skoda, Plzen (Czechoslovakia). Ustredni Vyzkumny a Zkusebni Ustav); Kubes, Z. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The failure analysis of a set of damaged thermocouples taken from a nuclear power plant included macroscopic as well as microscopic inspection of the outer surface of the mantle, microstructure analysis, and chemical analysis of the material of the mantle, wires and insulation. The interaction of the insulating material with moisture was studied. Cracks of various length and width were found on the outer mantle surface, indicating an effect of internal overpressure. Characteristics of the fractures were determined by electron microscopic examination. Under the effect of moisture, the insulating magnesium oxide transforms into magnesium hydroxide, which assumes a volume twice as large. If a microscopic corrosion crack develops in the thermocouple wall, moisture penetrates into the material and ultimately causes rupture of the mantle. (M.D.). 4 refs.

18842 (INIS-mf--13159, pp. 58-62) **Analysis of corrosion of the primary circuit heat exchangers at the Dukovany nuclear power plant.** Duba, Z. (Ceske Energeticke Zavody, Prague (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

In the operated heat exchangers, intense crevice corrosion of the sealing surfaces of the floating head, and pitting corrosion of the tube plate and of the floating head lid were observed. The corrosion was due to unsuitable material, to asymmetric bores in the tube plate giving rise to nonuniform plastic deformation, to imperfect rolling, and to microcracks in the sealing welded joint. As a remedial action, the following provisions shall be adopted: the exchangers shall be made of the 17 353 or X2ChrNiMoN22S3 steel, Teflon shall be used for sealing, problems of the cathodic protection of the exchangers shall be addressed at the designing stage, and the nuclear power plant licensee shall be provided with technology for repairs of the sealing surfaces and welded joints. (M.D.).

18843 (INIS-mf--13159, pp. 63-69) **Corrosion of nuclear power plant cooling circuits.** Bartonicek, R. (Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Cooling circuits of the auxiliary equipment suffers from pitting and crevice corrosion and from stress corrosion cracking. The susceptibility to corrosion is affected by the presence of chloride ions, by saturation with oxygen due to aeration, and by the concentration of copper and iron ions in water. The corrosion process and the sites of its usual occurrence are described. The corrosion problem can be alleviated by reducing the corrosion aggressiveness of water, improving the corrosion resistance of the steels, increasing the stability of the passive layer by steel purity, and by mechanical and chemical surface treatment. The steel resistance to pitting and crevice corrosion can be improved by increasing the molybdenum content to 2.5-3%. (M.D.). 1 ref.

18844 (INIS-mf--13159, pp. 70-74) **A complex approach to problems of secondary circuits with respect to the corrosion of steam generators.** Kopic, P. (Energoprojekt, Prague (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Steam generators suffer from surface loss of steel, local pitting and crevice corrosion and corrosion cracking. Important in this respect is the feedwater quality, in particular the concentration of salts (especially chlorides) and the presence of insolubles which form fixed deposits on the heat transfer surfaces. These surfaces must facilitate the heat transfer, the condenser must act as a reliable barrier between the pure condensate and the polluted cooling water. Procedures for removing sludges and deposits are described. Erosion is prevented by elevated alkalinization of water (pH>9.6). Although condensers at all Czechoslovak nuclear power plants are made of brass, this metal has not proved to be the best material for this purpose. Very good results, on the other hand, have been achieved with stainless steel regenerative heaters. Titanium will probably be the metal of choice for the condenser at the Temelin nuclear power plant. (M.D.).

18845 (INIS-mf--13159, pp. 80-84) **Degradation of materials of important technological nodes of nuclear power plants during operation.** Kupca, L. (Vyskumny Ustav Jadrovych Elektrarni, Trnava (Czechoslovakia)); Beno, P.; Brezina, M. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Slovak). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The basic problems of corrosion of WWER type primary circuits are dealt with. Stress corrosion cracking is a resultant of the synergistic action of three factors: the material susceptibility to corrosion cracking, the occurrence of strains, and the corrosion medium. The failure of the anticorrosion overlay of the reactor pressure vessel at unit 1 of the Bohunice nuclear power plant was due to the development of so-called hot cracks which arose during the production of the austenitic overlay, by their gradual merging and growth across all overlay layers due to the operation stress in the region of the necks. (M.D.). 6 figs., 5 refs.

18846 (INIS-mf--13159, pp. 85-89) **Corrosion resistance of Cr18Ni10Ti steel.** Burda, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Otruba, J.; Splichal, K. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The results are given of an investigation of the pitting and crevice corrosion and of the corrosion cracking of the title steel. Pitting corrosion was observed for steam generator tubes. Growth was found of open pits in the active state and of pits with an oxide layer. Deposits which formed on the heat exchange surfaces of the components during operation play an important part in the local corrosion. The initiation and growth of pits during the steam generator operation is strongly affected by the presence of chlorides and copper released by corrosion from the brass condenser tubes. Another kind of corrosion consists in the sub-surface damage of tubes, of the sealing welded joint and of the tube plate on the floating exchanger lid side. Mechanical stress of the thick-walled steam generator components along with the corrosive effect of the medium brings about failure of the structural material by corrosion cracking. Tube plates are the sites where corrosion cracking is most frequently initiated and developed. To ensure corrosion resistance of the steel, the amounts of aggressive components and corrosion products in water must be decreased, local mechanical stresses must be reduced, the surface quality must be improved and the presence of sulfide inclusions in the matrix must be restricted. (M.D.).

18847 (INIS-mf--13159, pp. 90-94) **Corrosion failure of a bolt made of the 25Kh1MF material.** Liska, V. (Skoda, Plzen (Czechoslovakia). Ustredni Vyzkumny a Zkusebni Ustav); Cechova, D.; Benedikt, V.; Velkoborsky, J. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

M36x4 bolts, of which there are 222 at each nuclear power plant unit, are made of the 25Kh1MF or 38KhN3MFA steel. They are located in an environment with elevated temperature, with damp air and with boric acid. Corrosion of these bolts is due to the rather poor metallurgical quality of the steel. No inadmissible inhomogeneities of the type of lines of inclusions occur in the bolt material produced by cold rolling but defects of the type of laps were found on the threads. It is suggested that if the cold rolling technology were obviated, corrosion failure of the bolts might not occur. (M.D.). 7 figs., 3 refs.

18848 (INIS-mf--13159, pp. 95-103) **Corrosion and erosion in saturated steam turbines.** Drahy, J. (Skoda, Plzen (Czechoslovakia). Zavod Energeticke Strojirenstvi). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Operation experience with corrosion and erosion is described for high-pressure components of turbines working with wet steam at relatively high pressures; this includes stress corrosion in steam turbine parts which originates in the Wilson line region, and corrosion fatigue of the moving blades in wet steam. The guide wheels of the high-pressure parts of the first two turbines in the nuclear power plant at Jaslovske Bohunice were made of carbon steel; strong corrosion erosion caused by the steam, however, was observed. Now the turbines are being made of 12% chromium stainless steel. Still more resistant to corrosion fatigue is the Ti-6Al-4V type titanium alloy possessing a fatigue limit about 30% higher than the chromium steel. The principal cause of corrosion of the material is the presence of impurities in the steam, particularly chlorides and sulfides, which deposit on the surfaces of the equipment components. (M.D.). 3 figs., 9 refs.

18849 (INIS-mf--13159, pp. 9-13) **Radiation embrittlement of 15Kh2MFA steel and welded joints as found based on the results of a surveillance programme.** Pav, T. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The condition of the WWER-440 reactor pressure vessel material is monitored by means of a system of surveillance specimens located at the periphery of the reactor core. They are made of three materials: the base material of the pressure vessel forging, the weld metal, and material with a heat affected zone formed during welding. The fast neutron fluence is monitored with activation detectors. The specimens are withdrawn periodically and subjected to mechanical tests, which include examination of the temperature dependence of the notch toughness. The radiation embrittlement coefficient and its dependence on the critical transition temperature were determined. (M.D.). 2 tabs., 2 figs.

18850 (INIS-mf--13159, pp. 14-23) **Radiation damage of the base material of a WWER-1000 reactor pressure vessel.** Havel, R. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Vacek, M.; Bodnar, L.; Brozova, A. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472--: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Test specimens were taken from the heads of the whole-forged rings at 1/3 of the wall thickness. The specimens for tensile tests were taken so that their longitudinal axis was perpendicular to the crack propagation plane in the Charpy-V bodies. The material of the specimens was heat treated in the same manner as the ring after welding; in this way the microstructure comprised a mixture of tempered bainite and martensite. Specimens for impact toughness tests were fitted with a fatigue crack and, subsequently, with side notches. They were irradiated in the WWR-S-Prague experimental reactor in an electrically heated probe. The tensile tests and the impact and notch toughness tests were accomplished in the standard manner. The observed radiation embrittlement, expressed in terms of the shift of the temperature dependence of the notch and impact toughness, lies sufficiently deep below the maximum permissible radiation embrittlement limit. The observed impact toughness is affected significantly by the size of the test specimens. The results give evidence that the 15Kh2NMFA steel, which was the subject of examination, satisfies radiation stability demands. (M.D.). 3 figs., 4 tabs., 5 refs.

18851 (INIS-mf–13159, pp. 120-126) **The combined effect of vibrations and low-cycle fatigue on the lifetime of the 15Kh2NMFA steel.** Linhart, V. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)); Aurednik, B.; Hnilica, F. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

A steel plate processed in the same way as the reactor pressure vessel wall was tested. The experiments were accomplished on an electrohydraulic stand and were controlled with a computer. The effect of stress on the lifetime was examined in conditions of controlled amplitude of the total deformation. The effect of stress on the crack propagation was tested on CT bars. The kinetics of fatigue crack growth was evaluated based on potentiometric measurements and by using an optical microscope. The fatigue crack growth rates under combined stress were found no higher than under high-cycle constant-amplitude stress. Additional high-cycle low-amplitude stress brought about a marked increase in the fatigue crack growth rate. (M.D.). 3 figs., 5 refs.

18852 (INIS-mf–13159, pp. 133-137) **Effect of local temperature changes on material fatigue of selected steam generator and pressurizer nodes.** Matal, O. (Vyzkumny Ustav Energetickych Zarizeni, Brno (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Additional thermocouples were installed in the Dukovany nuclear power plant, and data collected during the start-up and the initial stage of operation were recorded with multiline recorders. The frequency of temperature changes during the start-up was about 10 changes daily, with the fluctuations exceeding 40 degC. The measurements indicate that during any transient regime, dozens to hundreds of local fluctuations in the temperature stress take place. Many pressure variations and changes in the chemical effect of the working substances on the material occur as well. (M.D.). 2 figs., 5 refs.

18853 (INIS-mf–13159, pp. 143-147) **Life extension for bolts of primary collectors of WWER-440 steam generators.** Vejvoda, S. (Vojenska Akademie A. Zapotockeho, Brno (Czechoslovakia)); Mihalik, J. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The lifetime of bolts of the primary collectors of steam generators depends on the technology of their tightening. It is recommended that the nuts should be tightened with a hydraulic device which prestresses the bolts and tightens the nuts slightly, after which the pressure in the equipment is relieved. Tensometric measurements revealed bending stresses from 136 to more than 253.6 MPa. The bending stresses are most reduced if all the 20 bolts are tightened simultaneously by means of a hydraulic prestressing device using washers with steps and bolts with modified centering surfaces. The bolt lifetime was tested by repeated stressing on a pulsator. For bending stresses not exceeding 60 MPa and for the required chemical composition of the medium, the expected lifetime of the bolts is 30 years. (M.D.). 3 figs., 10 refs.

18854 (INIS-mf–13159, pp. 153-157) **Degradation processes during operation and their effect on materials of the equipment of nuclear power plants.** Srajer, V. (Sigma, Olomouc (Czechoslovakia)). Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The principal processes that can bring about loss of leakproofness include stable crack growth, tough fracture from overload, and unstable brittle fracture, the latter being the most hazardous. The notion of degradation is defined, and some mathematical relations characterizing the critical brittleness temperature are given. Examples of steel transition curves are given for the starting state, the state after aging, and the state after cyclic failure. (M.D.). 2 figs.

18855 (INIS-mf–13159, pp. 104-108) **The erosion effect of wet steam in nuclear power plant secondary circuits.** Karpisek, J. (Vyzkumny Ustav Energetickych Zarizeni, Brno (Czechoslovakia)); Matev, M.; Burda, R.; Nejezchleb, J. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

Steam separators for WWER type reactors were investigated with the aim to attain a uniform load of the separating beams by the steam flow and thus a more perfect separation. The erosion effect of the wet steam was reduced considerably. An internal structure to be built into the entrance chamber of the separator was designed based on results of aerodynamic tests. This internal structure causes the stream of wet steam to impact on the outlet tube of the separated and afterheated steam, to rebound on both sides and rebound again from the internal jacket of the entrance chamber. The entrance chamber contains compartments with opposite flows. The designs are described in detail. (M.D.). 2 figs.

18856 (INIS-mf–13159, pp. 109-113) **Development of a method and of equipment for corrosion-mechanical materials testing in the environment of the WWER type reactor coolant.** Kirsch, R. (Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia)); Hron, J. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

A computer-controlled test facility was developed for performing tests in media modeling the nuclear reactor. It contains machines subjecting the test specimens to cyclic dynamic stress. Initially, the facility was operated using pressure-free test chambers where the samples were exposed at low temperatures. A system for tests at a low constant deformation rate was also developed. Later the facility was equipped with non-through-flow autoclaves designed for dynamic tests in the reactor coolant medium, particularly of specimens of the pressure vessel materials. (M.D.). 1 fig., 3 refs.

18857 (INIS-mf–13159, pp. 127-132) **The effect of aqueous medium on fatigue crack growth conditions in materials of**

power generating facilities. Cerny, I. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)); Linhart, V.; Hnilica, F. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The effect on the fatigue crack growth rate of a corrosion medium, viz. water at 20 degC saturated with air oxygen, was examined for the 15Kh2NMFA steel. Under the given stress conditions, the aqueous medium has a favorable effect in the threshold stress region and in the region of slow crack growth. The threshold stress in water was approximately twice as high as in air. The corrosion product deposit was thickest on the fracture surfaces of the specimens in water. At stress frequencies of 40 to 50 Hz, the aqueous medium saturated with oxygen had no adverse effect. The threshold values in water were appreciably higher than in air whereas in the stable crack growth region, virtually no effect of water was observed. (M.D.). 2 figs., 1 tab., 7 refs.

18858 (INIS-mf–13159, pp. 148-152) **Cleavage failure theory and the feasibility of predicting the fracture toughness of radiation-embrittled low-alloy steel.** Holzmann, M. (Ceskoslovenska Akademie Ved, Brno (Czechoslovakia). Ustav Fyzikalni Metalurgie); Vlach, B.; Man, J. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The theory and the results of metallurgical investigation are given for the prediction of the temperature behavior of the static and, for some cases, also the dynamic fracture toughness. The changes in properties due to degradation during operation are taken into account. For low-carbon welding steel, the critical fracture stress was found unaffected by aging and by deformation aging. The structure changes taking place in the material due to irradiation and elevated temperatures can be characterized as precipitation hardening. Both the yield point and the deformation stresses increase as a result of precipitation of impurities and point defects. The feasibility is discussed of applying physical models to checking or predicting the effect of neutron radiation on the course of the fracture toughness. Mathematical relations are given for the dependence of the fracture toughness for static initiation, on the temperature and stress rate. (M.D.). 3 figs., 15 refs.

18859 (INIS-mf–13192, pp. 45-48) **Electrical transport and optical properties of granular metals.** Abeles, B. (Exxon Research and Engineering Co., Annandale, NJ (United States)). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Reviewed are some of the characteristic electrical transport, optical and superconducting properties of granular metals and how they are influenced by morphology. (Z.S.). 27 refs.

18860 (INIS-mf–13192, pp. 257) **Fracture initiation in Cr-Ni-Mo-V steel.** Brozova, A. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Keilova, E. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. STEEL-CR2NIMOV/fractures; CRACK PROPAGATION; STEEL-CR2NIMOV; FRACTURES

18861 (INIS-mf–13192, pp. 268) **The influence of neutron irradiation on the kinetics of annealing induced changes of Curie temperature of FeNiCrMoSiB amorphous alloys.** Skorvanek, I. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky); Matas, S.; Zentko, A.; Szymanski, B.; Blach, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOYS/physical radiation effects; ALLOYS; AMORPHOUS STATE; ANNEALING; CURIE POINT; NEUTRONS; RELAXATION

18862 (INIS-SU–309/A) **Radiation materials science. V. 4.** AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are processed separately for the data base.

18863 (INIS-SU–309/A, pp. 14-20) **Radiation embrittlement of WWER reactor vessel materials.** Amaev, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Kryukov, A.M.; Sokolov, M.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

In paper presents the main results of complex of investigation of irradiation embrittlement WWER-440 reactor vessel materials (RVM), carried out in the USSR. The object of investigations was surveillance specimens (SS) of RVM. It has been found that at an irradiation temperature of 270 deg C neighter the base metal nor weld metal exhibit saturation of irradiation embrittlement (IE). Regularities in the effect of impurity elements (Cu and P) on IE of RVM have been investigated. The effect of dependence of the IE characteristics of the WWER-440 RVM on the neutron flux has been found. 5 refs.; 4 figs.

18864 (INIS-SU–309/A, pp. 21-24) **Structural outflow and traps defining structural steel irradiation damage of temper conditions after quenching.** Morozov, A.M.; Nikolaev, V.A.; Rybin, V.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The irradiation damage of hull steel vs temper conditions and structure parameter change is studied. It is shown that temper time does not, practically, effect on irradiation embrittlement and hardening-temper temperature relationship is characterized by minimum in the range of changing from tempered martensite structure to poligonized cell sorbite structure. The derived relationship basically depends on two correlately changeable factors - outflow dislocation density and member of impurity intersitial atom traps. 4 figs.

18865 (INIS-SU–309/A, pp. 25-32) **Study of mechanical properties recovery processes of irradiated pressure vessel steels at annealing.** Amaev, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Kryukov, A.M.; Sokolov, M.A.; Badanin, V.I.; Nikolaev, V.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The main results of investigations on determination of the temperature-time annealing regimes of the WWER-440 reactor vessels (RV) with exhausted radiation operating lives are presented. The recovery degree of the critical temperature of steel brittleness, depending on the temperature and annealing duration as well as on the neutron fluence has been studied. The irradiation embrittlement rates in post-annealing reirradiation and reirradiation annealing eficiency were determined. 4 refs.; 7 figs.

18866 (INIS-SU–309/A, pp. 33-39) **Simulation of radiation embrittlement of materials for NNP reactor vessels.** Kevorkyan, Yu.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

A brief description of the ideology and organization of radiation embrittlement modelling of reactor materials is given. Difficulties experienced in construction of adequate physical models are pointed out. A model describing the kinetics of ferrite matrix strengthening by copper precipitates formed as a result of the radiation-induced phase decomposition is considered. The main data of the quantitative model analysis are presented. 8 refs.; 2 figs.

18867 (INIS-SU–309/A, pp. 40-46) **Metallurgical factors determining zirconium alloy irradiation behaviour.** Nikulina, A.V.; Peregud, M.M.; Shamardin, V.K.; Kobylyanskij, G.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The results are presented on the effect of zirconium alloy chemical compostion and heat treatment schedules on their mechanical properties, creep strain anf growth under irradiation to a neutron fluence of 7 x 10^{22} n/cm^2 (E >= MeV). The indicated factors are shown to play an important part in the irradiation resistance of zirconium base alloys; the regularities of their influence are revealed and the curves are constructed. Consideration is given to the effect of the phase constituents of the alloys. 4 refs.; 7 figs.; 2 tabs.

18868 (INIS-SU–309/A, pp. 47-54) **Effect of irradiation on zirconium alloy properties.** Platonov, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Ryazantseva, A.V.; Viktorov, V.F.; Semenova, L.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents data on the effect of irradiation on Zr -2.5% Nb and Zr - 1% Nb - 1% Sn - 0.55 Fe alloys based on out-of-pile studies on control and protection system channel and pressure tubes of the RBMK-1000 reactor. The data on corrosion behavior and hydrogen intake of the alloys under a prolonged exposure to reactor radiation and coolant is given. Changes in mechanical properties, cracking resistance and tendency to develop delayed hydride cracking of zirconium alloys as a function of fast neutron fluence and radiation temperature are shown. 2 figs.; 2 tabs.

18869 (INIS-SU–309/A, pp. 55-63) **High-speed high-frequency heat treatment and radiation growth of zirconium alloys.** Zelenskij, V.F. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Stukalov, A.I.; Neklyudov, I.M. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of high-speed heating up to beta-phase temperatures in products of zirconium-niobium alloys on their structure and texture variation is presented. A possibility for production of quasi-isotropic alloy structures under specific conditions of heat treating is shown. Results of radiation tests of zirconium alloy probes and products within 80-350 deg C temperature range in SM-2 and BOR-60 reactors up to 8 x 10^{26} m^{-2} fluences (E >= 0.1 MeV) are given. It is shown that the high-speed high-frequency treatment restricts significantly the alloys inclination for radiation derformation.8 refs.; 5 figs.; 2 tabs.

18870 (INIS-SU–309/A, pp. 64-72) **Radiation forming Zr alloy cladding and channel tubes at high neutron fluences.** Kobylyanskij, G.P. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)); Shamardin, V.K.; Ostrovskij, Z.E.; Raetskij, V.M.; Nikulina, A.V.; Peregud, M.M.; Grigor'ev, V.M. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron irradiation effect on radiation creep and growth of samples made of Zr material tubes in the BOR-60 reactor within the temperature range 320-370 deg C was investigated. Characteristic of dependence of creep strain and radiation growth of these tubes on neutron fluence up to 7.7 x 10^{26} m^{-2} (E >= 0.1 MeV) was studied. Influence of alloys mark, tangential stress and small changes of the average irradiation temperature upon the sample creep rate at high neutron fluences was shown. Effect of the tube production strain scheme, heat treatment, alloying and rolling direction on the dependence of radiation growth strain upon the neutron fluence was established. 6 refs.; 6 figs.; 2 tabs.

18871 (INIS-SU–309/A, pp. 90-97) **Features of radiation behaviour of fuel elements with vibropack uranium-plutonium oxide fuel.** Tsykanov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)); Maershin, A.A.; Skiba, O.V.; Petukhov, A.A.; Golubenko, I.S. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Comprehensive investigations of fuel elements with vibropacked and pelletized fuels carried out in RIAR make it possible to create a fuel element operating up to high burnups (15-20%). Preconditions are the specific features of fuel elements with vibropacked fuel in which cladding corrosion processes can be completely suppressed with use of getters; the cladding stressed state is much lower in transient modes and stress relaxation occurs considerably faster than in fuel elements with pelletized fuel. 6 figs.; 1 tab.

18872 (INIS-SU–309/A, pp. 98-104) **Effect of neutron irradiation on U_3Si structural and dimensional changes.** Panteleev, L.D. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Konovalov, I.I.; Krivova, V.I.; Manto, A.Yu.; Malygin, V.B.; Yashkov, V.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

U_3Si structural and dimensional changes were investigated. It is established that irradiation at a temperature 200 deg C and burnup 6-8 x 10^{17} fiss/cm^3 leads to the amorphization of U_3Si accompained by its volume increase maximally to 2.2-2.3%. During irradiation at 150-190 deg C the creep rate of pre-amorphous U_3Si specimes is 60-70 times the creep rate of crystalline specimens irradiated at 240 deg C. Based on the experiments and their analysis an explanation is suggested for the irradiation induced amorphization of crystalline U_3Si. A mechanism is suggested for the irradiation induced creep of amorphous U_3Si compound. 6 refs.; 5 figs.

18873 (INIS-SU–309/A, pp. 127-133) **Structure-phase transformations in thermotreated silicon crystals and their effect on electrical properties and radiation resistance.** Groza, A.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Varina, V.I.; Litovchenko, P.G.; Nikolaeva, L.G.; Starchik, M.I.; Shmatko, G.G.; Shevtsov-Kaz'mirchuk, P.G.; Brajlovskij, E.Yu.; Semenyuk, A.K. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Oxygen precipitation in silicon crystals was studied in depending on irradiation conditions (neutrons, protons, flux variation). It was shown the influence of type and value of flux irradiation the kinetics of precipitation and phase structure. The role of radiation damage in oxygen precipitation and phase structure. The role of radiation damage in oxygen precipitation is discussed. It was recieved that microdefects formed during oxygen precipitation influenced electrical properties of silicon crystals at room temperture weakly but could be as effective getters for radiation defects. 8 refs.; 6 figs.

18874 (INIS-SU–309/A, pp. 142-148) **Effect of fast heavy ion on monocrystalline semiconductors Si, GaP, Ge.** Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR)); Bugrov, V.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The damaging effect of fast heavy ions on monocrystalline Si, GaP, Ge is studied in the energy range of 20-130 MeV and at a fluence range of 10^{13}-10^{16} cm^{-2}. The direct crystallographic method based on the blocking effect at the registration of elastic scattering recoils is used. The ion damaging power is systematized as a function of the cross section of the atom displacememt, as well as of the electronic stopping power dE/dx. The anomalously low damaging power of the Xe ions is revealed in the interaction with a monocrystalline semicondutors, the similar behaviour of Si, GaP, Ge is confirmed. 6 refs.; 4 figs.

18875 (INIS-SU–309/A, pp. 156-160) **Nature of electron and thermal propertles of covalent semiconductors bombarded with fast neutrons.** Shpinar, L.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Yaskovets, I.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The semiconductors Si and Ge irradiated with fast neutrons are characterized by anomal temperature dependence of thermoconductivity, presence of single phonon absorption band ($\approx$488 cm^{-1}) and transformation of damage on short time after bombardment. In the present work we explain the above features as due to the presence of a number of disturb valence bonds. It is shown that above and other electrical and optical phenomena in irradiated semiconductors can be deduced from the form of the adiabatic potentials of disturbance bonds also. 5 refs.; 2 figs.

18876 (INIS-SU–309/A, pp. 161-166) **Effect of irradiation temperature and initial crystal doping level on defect creation efficiency in silicon.** Korshunov, F.P. (AN Belorusskoj SSR, Minsk (Belarus). Inst. Fiziki Tverdogo Tela i Poluprovodnikov); Markevich, V.P.; Medvedeva, I.F.; Murin, L.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The defect creation processes in n-type silicon irradiated by ^{60}Co gamma-rays or fast electrons (E = 4 MeV) have been investigated. Using electrical measurements the dependences of introduction efficiencies of the main radiation defects (A-, E-centres, carbon-related complexes) on the irradiation temperature (T_{irr} = 77-470 K) and material doping level ($N_n = 2 \times 10^{12} - 2 \times 10^{15}$ cm^{-3}) are obtained. It is shown that the efficiency of these defects formation is conditioned by the probability of the Frenkel pairs separation and depends strongly on the Fermi level position in crystals being irradiated. 9 refs.; 3 figs.; 1 tab.

18877 (INIS-SU–309/A, pp. 167-172) **Transformation of defects at annealing of silicon irradiated with great neutron fluences.** Pomozov, Yu.V. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Khirunenko, L.I.; Yashnik, V.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The processes of transformation of radiation defects at thermal annealing Si irradiated by neutrons were investigated. A splitting of the A-centre absorption band into 6 components was found. A conclusion that the structure of the band is due to appearence of new centres was made. It was concluded that the relation of intensities absorption bands of oxygen and their half-weights can be used for evaluation of internal elastic stresses. 6 refs.; 3 figs.

18878 (INIS-SU–309/A, pp. 191-202) **Amorphization of ion implantated GaAs.** Rzewuski, H. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The form of damage created as result of energy release of an ion penetrating the solid is of considerable interest in semiconducting device fabrication. The mechanisms of amorphization in ion implanted semiconductors have been the subject of many discussions and experiments. This overview covers shortly the presently accepted amorphization processes in the implanted semiconductors followed by last results for GaAs. 25 refs.; 15 figs.; 3 tabs.

18879 (IS-M–683) **Internal friction peaks due to oxygen, nitrogen and hydrogen in V-Nb alloys.** Buck, O.; Carlson, O.N.; Indrawirawan, H.; Brasche, L.J.H.; Peterson, D.T. Ames Lab., IA (United States). [1991]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-910374–2: American Society for Testing and Materials (ASTM) symposium on mechanics and mechanisms of material damping, Baltimore, MD (United States), 13-15 Mar 1991). Order Number DE92012155. Source: OSTI; NTIS; GPO Dep.

Richter's and Snoek's original works established the existence of an anelastic relaxation produced by a stress-induced interstitial reorientation in bcc metals. This anelastic relaxation, now referred to as a Snoek peak, has been studied extensively and well characterized in the past for the interstitials carbon, nitrogen, and oxygen. The existence of a hydrogen Snoek peak in bcc metals has been a matter of some controversy, however. We have studied relaxation peaks in V, Nb, and V-Nb alloys recently. The alloys have complete mutual solubility and are of interest since they have an extremely high room temperature solid solubility for hydrogen. They also have, over a certain composition range, not shown any hydride phase precipitation at temperatures as low as 4K. Thus, if a hydrogen Snoek peak does exist, it should be found in such alloys. Indeed there is evidence now of a spectrum of hydrogen relaxation peaks below room temperature. Furthermore, due to the difference in the atomic radii of V and Nb there is a large misfit in dilute alloys of these elements. This and possibly some chemical interaction can cause trapping (or antitrapping) of the interstitials at the substitutional sites, causing solute-interstitial peaks. The present paper provides an overview of our observations regarding: (1) the effect of hydrogen on the oxygen and nitrogen Snoek peaks in pure V and Nb, (2) the oxygen relaxation peaks in V-Nb alloys, (3) the hydrogen relaxation spectrum in V-Nb alloys, and (4) the effect of oxygen on the hydrogen relaxation spectrum in V-Nb alloys.

18880 (IS-M–700) **Evaluation of plasma sprayed crucible coatings for melt processing copper-refractory metal alloys.** Sordelet, D.J.; Ellis, T.W.; Laabs, F.C. Ames Lab., IA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-9206135–2: 1992 international thermal spray conference, Orlando, FL (United States), 1-5 Jun 1992). Order Number DE92010871. Source: OSTI; NTIS; GPO Dep.

A study was made to access the suitability of several plasma arc sprayed coatings applied to graphite for application as containment crucibles for melt processing copper-refractory metal alloys. Coatings of Ta, TaC, TaB_2 and ZrO_2-8w/o Y_2O_3 were evaluated and compared to uncoated graphite. The ZrO_2-8w/pY_2O_3 coating was sprayed over a tungsten bond coat. Prealloyed samples of Cu-15v/o Cr and Cu-15v/o Nb were placed within the crucibles and heated inductively to 1800°C and 2100°C, respectively. Compatibility of the coating-alloy system was evaluated by optical and scanning electron microscopy, EDS, XRD and combustion chromatography.

18881 (IS-T–1612) **Structure and stability of Al-Cu-Ru face-centered icosahedral alloys.** Shield, J.E. Ames Lab., IA (United States). 25 Feb 1992. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012550. Source: OSTI; NTIS; GPO Dep.

The phases and microstructures in rapidly solidified Al-Cu-Ru alloys were investigated in this study. A chemically and topologically disordered icosahedral (i) phase grows dendritically from the liquid as the primary solidification product over the entire compositional region studied. The as-solidified i-phase is metastable and transforms to crystalline products at ≈500°C. The i-phase was not found as a product of the exothermic transformation for any composition, indicating that it is not the low temperature stable phase in the Al-Cu-Ru system. A chemically and topologically ordered i-phase was found to be an equilibrium phase at temperatures above ≈670°C and exists over a compositional region of several atomic percent. Once formed, this phase was easily retained at lower temperatures because of kinetic limitations of the transformation to the low temperature crystalline phase.

18882 (Juel–2535) **An analysis of creep deformation and rupture by the β-envelope method.** Radhakrishnan, V.M.; Ennis, P.J.; Schuster, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Reaktorwerkstoffe. Oct 1991. 82p. Order Number DE92511505. Source: OSTI; NTIS (US Sales Only); INIS.

Recently early approaches based on creep equations have been revived to describe the creep deformation and fracture. In this report creep equations of the type $\epsilon_1=\beta_1 t^{1/3}$, $\epsilon_2=\beta_2 t$ and $\epsilon_3=\beta_3 t^3$ where ϵ_1, ϵ_2, ϵ_3 are the creep strains in the primary, secondary and tertiary stages, β_i the respective coefficients and t the time, are used to envelope the creep strain data on the log-log plot of creep strain versus time. Based on this approach the creep behaviour of the following engineering materials has been analysed: X10 NiCrAlTi 32 20 (Alloy 800 H), 13 CrMo 4 4 (1 Cr-0.5 Mo) steel in both new and service exposed conditions, 14 CrMoV 6 3 (0.5 Cr-0.5 Mo-0.25 V) steel a Ni-base superalloy. The analysis leads to an important modification of the Dobes-Milicka rule, namely, that the minimum creep rate ϵ_{min} and the rupture time t_r are related not only to the creep rupture strain ϵ_r but also to the creep strain at the end of the second stage ϵ_{23}, given in the form $\epsilon_{min} t_r=3\sqrt{\epsilon^2{}_{23}\cdot\epsilon_r}$. (orig./MM).

18883 (KCP–613-4501) **Process modeling and development for three axisymmmetric net shape forgings: Progress report 5.** El-Gizawy, A.S. (Missouri Univ., Columbia, MO (United States). Dept. of Mechanical Aerospace Engineering). Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Mar 1992. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012111. Source: OSTI; NTIS; GPO Dep.

The results of dynamic material modeling experiments are reported on aluminum alloys 6061 and 7050, and steel alloy 4340. This information was used to accurately describe the variables in the various constitutive equations used in computer modeling programs. A description of the experimental equipment used to deform the specimens and gather data was given. Previously reported work regarding computer modeling of interface friction and the forging process was reviewed. Using dynamic flow models, three different axisymmetric parts were analyzed for their potential for being produced by net shape or near net shape forging processes. Two aluminum alloy parts were recommended as potential candidates while the steel part was not a potential candidate. Recommendations for processing conditions were also given. 18 refs.

18884 (KCP–613-4502) **Dynamic material modeling in hot forging: Progress report 4.** El-Gizawy, A.S. (Missouri Univ., Columbia, MO (United States)). Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div.; Missouri Univ., Columbia, MO (United States). Mar 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012109. Source: OSTI; NTIS; GPO Dep.

A dynamic material model that characterized flow behavior in the workpiece under forging conditions was required to optimize the process and produce defect-free product at minimum cost. Constitutive equations describe the relationship between stress, strain rate, and temperature under forging conditions. Using aluminum alloy 7050, numerous deformation experiments were conducted to fully characterize constitutive equation variables. A thorough description of the experimental arrangement was provided. Flow data and efficiency data were assembled into a three-dimensional plot of temperature vs. strain rate vs. deformation efficiency to produce an efficiency map. The efficiency map provided the information required for optimization of forging process design. The results of dynamic modeling of the material were used in simulating the isothermal forging of a particular part. Recommendations concerning optimum preform design and processing conditions were reported.

18885 (KCP–613-4837) **Prototype casting fabrication by stereolithography.** Cromwell, W.E. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Mar 1992. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9204114–1: Allied-Signal Aerospace Company conference on computer aided engineering, Torrence, CA (United States), 29 Apr 1992). Order Number DE92011489. Source: OSTI; NTIS; GPO Dep.

The evolution of the new technology of producing CAD models by ultraviolet solidification of resin materials ("STEREOLITHOGRAPHY") continues to progress. The potential application area of rigid fabrication of prototype investment castings is becoming more feasible as we continue to successfully yield experimental castings by the "SHELL" processing method. This supplemental (to 11/90 publication) report briefly reviews the original project objectives, activities related to these objectives since November 1990, and progress made through December 1991. We discuss several new case studies involving new resin materials (and other materials) tested along with investment casting processing results. The most recent success, the processing of the highly complex "C" HOUSING design by the "shell" mold process in both aluminum and steel, will be discussed. This is considered a major breakthrough toward establishing this new technology as a viable approach to the rapid development of prototype investment castings, employing the most common aerospace (precision) cast process. Our future planning calls for expanding the study to help the investment casting industry in refining related processing techniques and to continue our evaluation of new resins suitable for the casting process. Present project planning calls for the completion of this study by the third quarter FY93 or sooner. We believe that with the continued excellent cooperation of our casting supplier study team and an accelerated effort by resin materials producers to further refine related materials, we can achieve all objectives during the planned time frame.

18886 (KFK–4905) **Surface analytical investigations of the interaction between the getter material ZrCo and hydrogen and the influence of different contamination gases on the hydrogen storage capacity.** Glasbrenner, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Kernfusion; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Chemie. Nov 1991. 124p. (In German). Order Number DE92511507. Source: OSTI; NTIS (US Sales Only); INIS.

In this work the results of surface analytical investigations of the alloy ZrCo used for hydrogen storage as well as of the interaction of the alloy with hydrogen and various contamination gases present in a nuclear fusion reactor will be presented and discussed with respect to the application of ZrCo as getter material for tritium. The characterization of the ZrCo alloy showed that on the surface a stable ZrO_2-layer is formed, which is, however, inhomogeneous. On the phase boundary solid /gas of samples exposed to hydrogen up to the stoichiometrical composition $ZrCoH_{2.8}$ a Co enrichment was observed. If the alloy ZrCo is activated before hydrogen take-up in the same way as other getter materials by heating under vacuum, the hydrogenation occurs faster and nearly complete. Zirconium is the alloy component responsible for the hydrogen storage. If a gas reacts nearly exclusively with the alloy component Co, a smaller decrease in the hydrogen storage capacity will be noticed. By exposition to CO and CO_2 mainly compounds with cobalt are formed. However, if the gas produces compounds with

Zr like carbide, nitride, or oxide, the result is a strong decrease of the hydrogen storage capacity of the getter. (orig./MM).

18887 (KFK–4909) **Processing and properties of mechanically alloyed sintered steels with hard inclusions.** Gutsfeld, C. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Material- und Festkoerperforschung 1 - Teilinstitut Kernbrennstoffe; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Maschinenbau. Oct 1991. 130p. (In German). Order Number DE92511179. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of this work was the development of mechanically alloyed sintered steels with inert hard inclusions and their characterisation concerning the mechanical properties and the sliding wear behaviour. For this material concept the hard materials NbC, TiC, TiN and Al_2O_3 were chosen with volume contents upto 20%. Mechanical alloying of the raw powders is a necessary prerequisit for an extreme fine and homogeneous microstructure and good mechanical and wear properties. Through a connecting powder annealing a conventional powder metallurgical processing with cold pressing and sintering is possible. For the consolidation pressureless liquid phase sintering initiated through phosphorus contents of 0,6% is suitable. Because of the strong hampering of grain growth through the included hard particles sintering densities upto 99% TD are possible with extreme fine microstructures. The mechanical properties can be varied in wide ranges. So tensile strengths of 1150 MPa, elongations at fracture of 17%, hardness of over 800 HV and fatigue strengths of 370 MPa have been reached. Throughout HIP or sinter forging the mechanical properties can be improved furthermore. (orig.).

18888 (KIYal–90-17) **Investigation of radiation defects in InSb formed by charged high energy nuclear particles.** Vikhlij, G.A.; Karpenko, A.Ya.; Litovchenko, P.G.; Tarabrova, L.I.; Groza, A.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 27p. (In Russian). Order Number DE92625643. Source: OSTI; NTIS (US Sales Only); INIS.

A possibility of creation of high concentrations of radiation defects in the bulk of InSb samples by 47 MeV protons and 80 MeV alpha particles is considered. Dose dependences of electroconductivity, optical absorption spectra as well as temperature and field relations of galvanomagnetic properties of samples with defects are investigated. Annealing stages and electrical properties of defects annealed at these stages are determined. 17 refs.; 7 figs.

18889 (LA-UR–92-659) **Influence of strain rate on the structure/property behavior of the alpha-2 alloy Ti-24.5Al-10.5Nb-1.5Mo.** Gray, G.T. III (Los Alamos National Lab., NM (United States)); Hong, Sun Ig; Marquardt, B.J. Los Alamos National Lab., NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920604–1: 7. world conference and exhibition on titanium, San Diego, CA (United States), 28 Jun - 2 jul 1992). Order Number DE92008490. Source: OSTI; NTIS; GPO Dep.

Preliminary dislocation g·b analysis revealed that following room temperature deformation at low strain rate the majority of the dislocations are a-dislocations lying on basal planes, 2nd order pyramidal (a/2 + c) slip on [1211], and 1st order pyramidal a-slip on [1011]. Increasing the rate of deformation at room temperature to 6000 s^{-1} is seen to result in increased a-slip on prism planes and a decreased amount of basal slip. At high-strain-rates and elevated temperatures the substructure was seen to be generally similar to that observed following high-rate deformation at room temperature except for an increased amount of basal slip and a somewhat higher incidence of 2nd order pyramidal slip. The defect generation and the rate sensitivity of Ti-24.5Al-10.5Nb-1.5Mo are discussed as a function of strain rate and temperature and contrasted to that observed in conventional titanium alloys and TiAl.

18890 (LA-UR–92-667) **Plastic flow in weak shock waves in uranium.** Tonks, D.L. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205137–1: International seminar on physics and gas dynamics and shock waves, Minsk (USSR), 27 May - 2 jun 1992). Order Number DE92011270. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of the particle velocity in weak shock waves in metals are available for a number of materials. These measurements use the laser interferometer or VISAR technique in conjunction with a plate impact experiment. These measurements are important for determining the elastic – plastic behavior of materials at high strain rates. Strain rates up to 10^7/s are measurable with this technique, while more conventional mechanical testing machines, such as the Hopkinson bar, achieve rates only up to about 10^4/s. In this paper, the VISAR measurements of Grady on uranium are analyzed using the weak shock analysis of Wallace to extract the plastic and total strains, the deviatoric and total stresses, and the plastic strain rates. A brief error analysis of the results will be given. 7 refs.

18891 (LA-UR–92-887) **Omega phase formation in titanium and titanium alloys.** Gray, G.T. III; Morris, C.E.; Lawson, A.C. Los Alamos National Lab., NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920604–2: 7. world conference and exhibition on titanium, San Diego, CA (United States), 28 Jun - 2 jul 1992). Order Number DE92011136. Source: OSTI; NTIS; GPO Dep.

Although the response of titanium alloys to dynamic loading is receiving increased attention in the literature (particularly in the area of shear-band formation), a more limited experimental database exists concerning the detailed structure/property relationships of titanium alloys subjected to shock loading. In this study, preliminary results concerning the influence of alloy chemistry on the property of omega-phase formation and its structure in three titanium alloys are presented. The influence of shock-wave deformation on the phase stability and substructure evolution of high-purity (low-interstitial) titanium, A-70 (3700 ppm oxygen) titanium, and Ti-6Al-4V were probed utilizing real-time velocity interferometry (VISAR) and "soft" shock-recovery techniques. VISAR wave profiles of shock-loaded high-purity titanium revealed the omega-phase pressure-induced transition to occur at approximately 10.4 GPa. Wave profile measurements on A-70 Ti shocked to pressures up to 35 GPa and Ti-6Al-4V shocked to pressures up to 25 GPa exhibited no evidence of a three-wave structure indicative of a pressure-induced phase transition. Neutron and X-ray diffractometry and TEM analysis confirmed the presence of retained ω-phase in the electrolytic-Ti and the absence of ω-phase in the shock-recovered A-70 Ti and Ti-6Al-4V. Suppression of the α-ω phase transition in A-70 Ti, containing a high interstitial oxygen content, is seen to simultaneously correlate with suppression of deformation twinning. Neutron diffraction was used to measure the in-situ bulk lattice constants and volume fraction of the α and ω phases in the recovered high-purity titanium samples that were shock loaded. The influence of alloy content on the kinetics of formation/retention of ω-phase and substructure evolution is discussed and contrasted in light of previous literature studies.

18892 (ORNL/M–2001) **Bibliography of the technical literature of the Materials Joining Group, 1951–1991.** David, S.A.; Goodwin, G.M.; Gardner, K. (comps.). Oak Ridge National Lab., TN (United States). Dec 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92011503. Source: OSTI; NTIS; GPO Dep.

This document contains a listing of the written scientific information originating in the Materials Joining (formerly the Welding and Brazing Group), Metals and Ceramics Division, Oak Ridge National Laboratory during 1951 through June 1991. This registry of documents is as much as possible, in the order of issue date.

18893 (RFP–4447-Pt.1-Rev.) **Acoustic emission from single point machining: Part 1, Source mechanism: Revised.** Heiple, C.R.; Carpenter, S.H.; Armentrout, D.L.; McManigle, A.P. EG and G Rocky Flats, Inc., Golden, CO (United States). [1989]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. Order Number DE92012113. Source: OSTI; NTIS; GPO Dep.

Acoustic emission (AE) was monitored during single point, continuous machining of 4340 steel and Ti-6A1-4V as a function of heat treatment. Heat treatments which increase the strength of 4340 steel increase the amount of AE produced during deformation, while heat treatments which increase the strength of Ti-6A1-4V decrease the amount of AE produced during deformation. Trends in rms AE level during machining with increasing strength were similar for both alloys, demonstrating that chip deformation is not a major source of AE in sigle point machining. The data suggest that sliding friction between the nose and/or flank of the tool and the newly machined surface is the primary source of AE.

18894 (RFP–4447-Pt.2-Rev.) **Acoustic emission from single point machining: Part 2, Signal changes with tool wear: Revised.** Heiple, C.R.; Carpenter, S.H.; Armentrout, D.L.; McManigle, A.P. EG and G Rocky Flats, Inc., Golden, CO (United States). [1989]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. Order Number DE92012114. Source: OSTI; NTIS; GPO Dep.

Changes in acoustic emission signal characteristics with tool wear were monitored during single point machining of 4340 steel and Ti-6Al-4V heat treated to several strength levels, 606l-T6 aluminum, 304 stainless steel, 17-4PH stainless steel, 410 stainless steel, lead, and teflon. No signal characteristic changed in the same way with tool wear for all materials tested. A single change in a particular AE signal characteristic with tool wear valid for all materials probably does not exist. Nevertheless, changes in various signal characteristic with wear for a given material may be sufficient to be used to monitor tool wear.

18895 (RFP–4565) **Electrorefining of cerium: Part 2, Cerium as a surrogate for plutonium electrorefining studies.** Raraz, A.G. (Colorado School of Mines, Golden, CO (United States). Kroll Inst. for Extractive Metallurgy); Mishra, B.; Olson, D.L.; Moore, J.J. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant; Colorado School of Mines, Golden, CO (United States). Kroll Inst. for Extractive Metallurgy. Jan 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. Order Number DE92010949. Source: OSTI; NTIS; GPO Dep.

The plutonium metal produced by the Direct Oxide Reduction Process is associated with other metallic impurities that have to be removed. The purification of plutonium is achieved using electrorefining process through a molten salt medium. The optimization of process parameters involved in electrorefining is required to make the process effective, in terms of the metal purity, cell efficiency and overall process reliability. Since the study of strategic and radioactive metals requires the use of a surrogate, it is important to choose surrogates that simulate the process as closely as possible. Cerium has been chosen to study the electrorefining behavior of plutonium. The differences that exist in the physico-chemical properties between the two metals have been critically examined and appropriate models have been developed to study the behavior. Cerium is a justified choice for the investigation.

18896 (SAND–92-0594C) **Metal vapor plasma behavior during vacuum arc remelting of alloy 718.** Zanner, F.J. (Sandia National Labs., Albuquerque, NM (United States)); Maguire, M.C.; Williamson, R.L.; Adasczik, C.B.; Roberts, R.R.; Strohecker, R. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205142–1: 11. international conference on vacuum metallurgy, No City Given (France), 11-14 May 1992). Order Number DE92011761. Source: OSTI; NTIS; GPO Dep.

A production vacuum arc remelt (VAR) furnace was modified to enable direct viewing of the metal vapor arc and molten electrode tip during melting of 432 mm dia. alloy 718 electrodes into 508 mm dia. ingots. Diffuse and constricted arcing conditions were characterized using high speed cinematography, standard video format, and monochromatic imaging. Constricted arcing was observed while melting electrodes contaminated with oxide slag of the type used for refractory linings in vacuum induction furnaces. Monochromatic imaging was used in visualize the ion distribution in the arc plasma; these images clearly showed whether the arc operated in a diffuse or constricted model. Diffuse arc melting conditions were very similar to those previously reported in the literature for smaller laboratory sized melts.

18897 (SAND–92-8411C) **The structure and properties of grain boundaries in Ni_3Al.** Mills, M.J.; Goods, S.H.; Foiles, S.M. Sandia National Labs., Livermore, CA (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-911202–77: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92012143. Source: OSTI; NTIS; GPO Dep.

The mechanical behavior of polycrystalline intermetallic compounds are often strongly influenced by the properties of the interfaces present. A classic example of this is the intergranular fracture exhibited by polycrystalline Ni_3Al, and the dramatic increase in ductility upon the addition of small amounts of boron. It has been proposed that boron may promote the transmission of slip across grain boundaries by inducing the formation of a local region of compositional disorder. The results of experimental efforts to characterize the effect of boron on the structure and chemistry of these grain boundaries are summarized. Recent high resolution transmission electron microscopy studies using oriented bicrystals are described which indicate that there is no apparent change in the compositional ordering to within 0.5 nm from the boundary. These experimental results are compared with the results of atomistic calculations which have been used to examine the effect of stoichiometry and boron content on the energy and degree of ordering of these boundaries. The proposed mechanisms of intergranular fracture in Ni_3Al are discussed based on this experimental and theoretical work.

18898 (STU–87-3808) **Surface modification and protection of ODS-alloys.** Engman, U. (Studsvik AB, Nykoeping (Sweden). Materialteknik). Swedish National Board for Technical Development, Stockholm (Sweden). May 1991. 118p. Order Number DE92506591. Source: OSTI; NTIS (US Sales Only).

This report has 5 separately indexed papers.

Swedish contributions to a Euram cooperation on ODS-alloys are collected in this report. The purpose of the project was to develop and study suitable diffusion barriers between ODS-alloys and FeCrAlY-coatings. A joint report by all participating partners will be published later.

18899 (UCRL-ID–110428) **Casting process modeling using ProCAST and CAST2D – Mold filling, solidification and structural response.** Stein, W.; Shapiro, A.B. Lawrence Livermore National Lab., CA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013262. Source: OSTI; NTIS; GPO Dep.

Correctly modeling the fluid flow and heat transfer during the filling of a mold with a molten fluid is important in predicting the quality of a cast part. Determining the dynamics of the flow and the free surface shape during filling are essential in establishing the temperature gradients in the melt and in the mold. After filling the mold, solidification may be greatly affected by natural convection effects. Further, correctly modeling the physics across the solidifying part-mold interface is crucial in predicting the part final shape. Most metals undergo a volume change on solidification (e.g. aluminum-6.6%) and shrinkage on cooling. As the cast metal shrinks, it pulls away from the mold wall creating a gap. This gap affects the thermal contact resistance between the part and mold. The thermal contact resistance increases as the gap widens. This directly affects the cooling rate and ultimately the final cast shape, stress state, and quality of the cast part.

18900 (UCRL-JC–104592) **The role of off-diagonal disorder on alloy phase stability: An application to the Ni-Pt system.** Sluiter, M.; Turchi, P.E.A. Lawrence Livermore National Lab., CA (United States). 10 Dec 1990. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-901105–134: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 24 Nov - 1 dec 1990). Order Number DE92011395. Source: OSTI; NTIS; GPO Dep.

The occurrence of ordering in the Ni-Pt alloy system seems to violate theoretical predictions based on a tight-binding description of the electronic structure. In these descriptions of transition metal alloys, ordering is predicted if the d-band is about half filled, and phase separation is predicted if the d-band is almost empty or almost full. This so-called bandfilling argument clearly fails in the case of Ni-Pt alloys, which order despite an almost filled d-band. The band filling rule is derived under the assumption that off-diagonal disorder (ODD), that is, the difference in d-bandwidths of the constituents, can be ignored. However, it has been argued that taking ODD into account would result in an even stronger phase separation tendency in the theoretical prediction. Magnetism is not a factor in equiatomic Ni-Pt alloys, and thus can not be invoked to correct the erroneous prediction. Other factors, such as spin orbit coupling in the relativistic description of Pt can change the prediction only if very large spin orbit splitting is assumed on the Pt atom. In this paper, the effect of ODD is examined and evaluated. It has been shown that when ODD is taken into account, ordering is indeed predicted although the order-disorder temperatures tend to be lower than those experimentally observed. The densities of states (DOE) computed with, and without ODD are contrasted and the energetic properties as defined by the Generalized Perturbation Method (GPM) are employed to determine the ground state of the alloy at three compositions, Ni_3Pt, NiPt, and $NiPt_3$, and to compute order-disorder temperatures.

18901 (UCRL-JC-105329) **Processing and failure studies of advanced composites using x-ray tomographic microscopy (XTM).** Kinney, J.H. (Lawrence Livermore National Lab., CA (United States)); Saroyan, R.A.; Celeste, J.; Nichols, M.C.; Stock, S.R.; Breunig, T.M.; Guviniler, A. Lawrence Livermore National Lab., CA (United States). Feb 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910399-6: American Society for Nondestructive Testing spring conference, Oakland, CA (United States), 18-22 Mar 1991). Order Number DE92011463. Source: OSTI; NTIS; GPO Dep.

The traditional role of Non-Destructive Testing (NDT) has been to identify critical flaws in components after they have been fabricated. Recently, efforts have been made to introduce NDT techniques earlier in the engineering cycle, and some progress has been made in applying NDT inspection during component processing. Improvements that have been made in the spatial resolution and sensitivity of x-ray computed tomography (CT), however, indicate that it is now possible to introduce NDT concepts and methods to the earliest stage of component manufacture, namely, in the development of new materials – where the characterization and analysis of microscopic features are important. X-ray tomographic microscopy (XTM) is a high resolution, three-dimensional variant of CT with a spatial resolution better than 0.005 mm. These studies have demonstrated that XTM is a powerful NDT technique which is capable of imaging microstructural features in even the most complicated advanced composite materials. Work is in progress to use XTM for dynamic studies of chemical vapor infiltration in continuous fiber ceramic composites. Furthermore, an in-situ tensile load frame is now being used in conjunction with XTM to study fatigue crack growth and tensile failure in metal matrix composites. The application of NDT imaging methods to materials studies will greatly enhance our understanding of time-dependent behavior in complex engineering materials. 3 refs.

18902 (UCRL-JC-106149) **The real-space multiple-scattering theory and the electronic structure of grain boundaries.** Sowa, E.C. (Lawrence Livermore National Lab., CA (United States)); Gonis, A.; Zhang, X.G. Lawrence Livermore National Lab., CA (United States). May 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910406-40: Spring meeting of the Materials Research Society (MRS), Anaheim, CA (United States), 29 Apr - 3 may 1991). Order Number DE92013006. Source: OSTI; NTIS; GPO Dep.

We describe the recently developed real-space multiple-scattering theory (RSMST), which is designed for performing first-principles electronic-structure calculations of extended defects, such as surfaces and interfaces including atomic relaxations and with or without impurities, without using artificial periodic boundary conditions. We present the results of non-charge-self-consistent RSMST calculations of the local electronic densities of states at twist and tilt grain boundaries in fcc Cu and bcc Nb, and report on progress towards the implementation of charge self-consistency and total-energy capabilities.

18903 (UCRL-JC-107696) **The role of chemical interactions in the stability of artificial metallic superlattices.** Sluiter, M.; Turchi, P.E.A. Lawrence Livermore National Lab., CA (United States). 23 Dec 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911202-70: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92011528. Source: OSTI; NTIS; GPO Dep.

Atom by atom deposition techniques, such as magnetron sputtering, make possible the synthesis of artificial superlattices with composition modulations in one dimension on an atomic scale. Generally, elastic effects (lattice mismatch) and chemical affinity (ordering or clustering tendencies) are recognized as the most important driving forces for the thermodynamic stability of such materials. In this study the chemical aspect of stability will be examined using a formalism based on the first-principles electronic structure calculations developed originally for bulk alloys. The formalism has been applied to a number of systems with fcc and bcc transition metals as constituents. In some cases the stability of artificial superlattices was found to depend in a rather surprising and unexpected way on the direction and wavelength of the composition modulation.

18904 (UCRL-JC-107793) **Stabilization of face-centered-cubic titanium.** Jankowski, A.F.; Wall, M.A. Lawrence Livermore National Lab., CA (United States). Nov 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911202-75: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92011530. Source: OSTI; NTIS; GPO Dep.

The artificial layering of metals can change both physical and structural characteristics from the bulk. The stabilization of such phases often occurs when the component layers are constructed on a nanometric scale. The sequential layering of nickel and titanium has produced the formation of a previously unreported, face-centered-cubic (f.c.c.) phase of titanium.

18905 (UCRL-JC-107866) **An innovative approach for coupled thermomechanical analysis.** Whirley, R.G.; Engelmann, B.E. Lawrence Livermore National Lab., CA (United States). 8 Aug 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911213-25: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92011467. Source: OSTI; NTIS; GPO Dep.

This paper describes a staggered step formulation for coupled thermomechanical problems, and the implementation of this approach into a new nonlinear finite element code, PALM2D. The staggered step approach considers the coupled thermomechanical response of solids, including nonlinear effects in both the thermal and mechanical aspects. The thermal problem may include temperature dependent thermal conductivities and convection boundary conditions, and the mechanical problem may include large deformations and strains as well as material nonlinearities such as plasticity. Heat generation due to mechanical plastic deformation is incorporated into the energy equation, and the energy equation is solved on the current deformed geometry. Experience to date indicates that this approach allows an inexpensive solution to many strongly nonlinear fully coupled thermomechanical problems.

18906 (UCRL-JC-107883) **An implementation of Hill's theory of normal anisotropic plasticity for explicit shell analysis.** Whirley, R.G.; Engelmann, B.E. Lawrence Livermore National Lab., CA (United States). 20 Aug 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9109364-1: 1991 DYNA3D user's group conference, Bournemouth (United Kingdom), 27-28 Sep 1991). Order Number DE92011468. Source: OSTI; NTIS; GPO Dep.

This paper summarizes the formulation and numerical implementation of a general anisotropic elastic-plastic material model for shell analysis. The 1948 Hill yield function is presented and specialized to conditions of plane stress. Next, an unconditionally stable and fully vectorized numerical algorithm for this constitutive model is presented. Finally, the model is specialized to conditions of normal anisotropy, and the implementation in DYNA3D is discussed. This development in material modeling should substantially extend the applicability of DYNA3D for many sheet metal forming applications. Several large-scale sheet metal forming examples are presented to illustrate these new analysis capabilities. 9 refs.

18907 (UCRL-JC–108606) **A first-principles study of phase stability in Ni-Al and Ni-Ti alloys.** Sluiter, M. (Lawrence Livermore National Lab., CA (United States)); Turchi, P.E.A.; Pinski, F.J.; Stocks, G.M. Lawrence Livermore National Lab., CA (United States). Sep 1991. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC05-84OR21400. (CONF-910938–10: International conference on high temperature aluminides and intermetallics, San Diego, CA (United States), 17-19 Sep 1991). Order Number DE92011046. Source: OSTI; NTIS; GPO Dep.

The thermodynamic stability of the bcc and fcc based order phases in Ni-Ti and Ni-Al has been studied with a highly accurate first-principles electronic structure method. The occurrence of a martensitic transformation in Ni-Al B2 ordered intermetallic alloys will be discussed and related to the existence of intermediate structures between bcc and fcc based phases. It will be shown that closely related ordered structures can exist on fcc and bcc lattices in the composition range where the transformation occurs. A variety of antiphase boundaries in the B2 and L12 structures will be examined and the pertinent energies will be compared with experimental data. In addition, the rather unusual appearance of the NiTi B2 ordered structure in the phase diagram will be discussed.

18908 (UCRL-JC–108728) **Effect of grain size on deformation stability of copper under quasi- static and dynamic tensile loading.** Lassila, D.H.; Gourdin, W.H. Lawrence Livermore National Lab., CA (United States). 31 Oct 1991. 15p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911195–3: Army symposium on solid mechanics: synergism of mechanics, mathematics and materials, Plymouth, MA (United States), 4-7 Nov 1991). Order Number DE92012677. Source: OSTI; NTIS; GPO Dep.

The effects of grain size on the deformation stability of copper deformed in tension under quasi-static and dynamic conditions have been studied experimentally and analytically. Oxygen Free Electronic (OFE) copper samples with grain sizes of 15 μ and 120 μm were tested. Results of the tests indicated that an increase in grain size resulted in greater extents of elongation prior to deformation instability and eventual failure under both quasi-static and dynamic loading. We have applied the deformation stability condition of Considere to both a simple power law modified to include a Hall-Petch grain size dependence and the more descriptive mechanical threshold stress (MTS) model. Calculations of the stress-strain behavior in uniaxial tension and the instability strain under quasi-static loading are compared with experiment. Both models predict an increase in the instability strain with increasing grain size, but the power law, included as a heuristic, yields a poor overall fit to both the stress-strain and the instability strains. Under dynamic loading comparison of the experimental results with analytical predictions were difficult due to inherent inaccuracy in the dynamic stress-strain data.

18909 (UCRL-JC–108838) **Stability of metallic superlattices.** Turchi, P.E.A.; Sluiter, M. Lawrence Livermore National Lab., CA (United States). 8 Nov 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9203130–1: Optical Society of America (OSA) meeting, Jackson Hole, WY (United States), 2-5 Mar 1992). Order Number DE92011526. Source: OSTI; NTIS; GPO Dep.

An approach is presented for the study of the thermodynamic stability properties of artificial superlattices. General expressions are derived for the configurational energy as a function of the superlattice parameters, and also for the interfacial energy. Finally, the relationship between some artificial superlattices and naturally occurring ordered phases are briefly discussed.

18910 (UCRL-JC–109024) **Molecular dynamics modeling of the mechanical properties of metal surfaces at the nanometer scale.** Belak, J.; Stowers, I.F. Lawrence Livermore National Lab., CA (United States). Mar 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920439–5: International conference on metallurgical coatings and thin films, San Diego, CA (United States), 6-10 Apr 1992). Order Number DE92010705. Source: OSTI; NTIS; GPO Dep.

We present an overview of the molecular dynamics computer simulation method as employed in the study of the mechanical properties of surfaces at the nanometer scale. The embedded atom method is used to model a clean metal surface and the computer experiment consists of the indentation and scraping of a hard diamond-like tool into and across the surface. The metal surface consists of 36 layers of atoms initially arranged on an fcc lattice with a rigid lower boundary condition. Results are presented for the (111) surface of copper and silver. We explicitly demonstrate in our point indentation simulations that nanoscale plasticity takes place by nondislocation mechanisms, a result suggested by recent nanoindentation experiments. We also observe the surface to accommodate nearly the entire volume of the tip and the annealing out of plastic work as the tip is removed. In our orthogonal cutting simulation, we observe an interesting phenomenon: the system dynamically reorients the grain in front of the tool tip to minimize the work performed on the shear plane (i.e. the shear plane becomes an easy slip plane).

18911 (UCRL-JC–109268) **A fast laser alloying process for the selective electroplating of metal on SiO_2 and polyimide.** Malba, V.; Bernhardt, A.F. Lawrence Livermore National Lab., CA (United States). 18 Dec 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911202–76: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92011764. Source: OSTI; NTIS; GPO Dep.

A new laser direct-write process for patterning of metal on multichip modules has been developed. The process involves the laser modification of the non-conductive surface of a seed multilayer, converting it to a conductive surface, which can be electroplated with metal. The seed multilayer is composed of a TiW adhesion layer, onto which a Au film is sputtered, followed by an a-Si layer, which forms the non-conductive surface. The laser modifies the surface by alloying (or mixing) the Si and Au to form the conductive surface. This laser process has been shown to be capable of writing speeds of 2.5 m/s. With a silicon dioxide interlevel dielectric layer, the process works over a large range of laser power ($P_{max}/P_{min} \sim 5$). A polyimide interlevel dielectric layer can be used without damage or loss of adhesion, although the process margin is substantially reduced ($P_{max}/P_{min} \sim 2$).

18912 (UCRL-LR–109230) **Hazards of using tantalum parts in a molten plutonium environment.** Furr, J.S. Lawrence Livermore National Lab., CA (United States). 19 Oct 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012565. Source: OSTI; NTIS; GPO Dep.

Tantalum experiences severe intergranular attack (IGA) when in contact with molten plutonium. This IGA of tantalum has produced part failures in crucibles used during Trident and molten salt extraction (MSE) runs and in two stirring rods used in MSE runs. These parts were used at temperatures ranging from 750°C to 900°C for a minimum time of 12 hours to a maximum time of 20 hours. 5 refs., 22 figs.

18913 (UCRL-LR–109425) **Superplasticity in a nickel silicide alloy, Ni_3Si (V,Mo).** Stoner, S.L. Lawrence Livermore National Lab., CA (United States). Dec 1991. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011651. Source: OSTI; NTIS; GPO Dep.

The fundamentals of superplasticity, including mechanical and microstructural characteristics are reviewed. The interest in developing intermetallic alloys for high temperature, structural applications is discussed. The superplastic properties of an intermetallic alloy based on nickel silicide have been investigated. A duplex microstructure is shown with a third phase present as dispersions. The β phase is ordered and the $(\alpha+\beta)$ phase is a mixture of a solid solution phase and β dispersions. The mechanical behavior of the material is presented. The maximum strain-rate sensitivity is approximately 0.5. The stress/strain curve varies with temperature, strain-rate, and orientation of the tension with respect to the microstructure. Steady-state behavior is shown in Region II as well as strain hardening caused by dynamic growth of the β phase. ($\alpha+\beta$) grains refine with deformation. Growth and refinement are enhanced at slower strain-rates. The nickel silicide alloy cavitates during superplasticity and shows increasing cavitation with decreasing strain-rate. The failure mechanism is intergranular and the final failure occurs by cavity coalescence. Annealing the material prior to testing produced a more uniform microstructure and improve the superplastic performance of the alloy. 43 refs.

18914 (WSRC-MS--90-93) **The mechanical behavior of extruded powder aluminum subjected to biaxial loadings at elevated temperature.** Woods, T.O. (Georgia Inst. of Tech., Atlanta, GA (United States)); Berghaus, D.G.; Peacock, H.B. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9008168--1: 9. International conference on experimental mechanics, Copenhagen (Denmark), 20-24 Aug 1990). Order Number DE92011257. Source: OSTI; NTIS; GPO Dep.

The goal of this investigation is to develop a description of the biaxial behavior of extruded powder aluminum at elevated temperature. Specimens made of extruded 101 ALCOA (Aluminum Company of America) powder aluminum and specimens made from 1100 commercial aluminum rod are tested biaxially in tension-torsion and compression-torsion loadings at the extrusion temperature. The powder aluminum is examined microscopically and stereological methods are used to give a quantified description of the material behavior in terms of changes in the laminar powder material structure. A model for the biaxial (tension-torsion) behavior of extruded powder aluminum is developed. This description is consistent with a previous analysis of behavior in pure tension.

18915 (WSRC-MS--90-105) **The effects of hydrogen isotopes and helium on the tensile properties of 21-6-9 stainless steel.** Morgan, M.J. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-901008--14: Fall meeting of the Minerals, Metals and Materials Society (TMS), Detroit, MI (United States), 7-11 Oct 1990). Order Number DE92011256. Source: OSTI; NTIS; GPO Dep.

High-energy-rate-forged (HERF) stainless steels are used as the materials of construction for tritium and deuterium reservoirs. Hydrogen and helium, the decay product of tritium, are known to embrittle stainless steels (1--4). The resistance to hydrogen and helium induced embrittlement is relatively good for HERF stainless steels when compared to annealed stainless steels due to their high number density of dislocations, which act as traps for hydrogen and helium. However, the degree of the embrittlement in these materials can vary considerably because of microstructure and yield strength variations introduced during the forging process. In this study the effect of hydrogen and tritium on the room temperature tensile properties of 21-6-9 stainless steel was measured as a function of HERF yield strength in the range of 500 to 918 MPa. The effect of a microstructures was studied also by conducting tensile tests with both HERF samples and annealed samples.

18916 (Y/DW--1125) **Transmission electron microscope characterization of deformation and recovery in 304L stainless steel part.** Mabon, J.C. (Oak Ridge Y-12 Plant, TN (United States)); Fleenor, M.C.; Carpenter, D.A.; Smith, W.H. Oak Ridge Y-12 Plant, TN (United States). Dec 1991. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92013237. Source: OSTI; NTIS; GPO Dep.

Type 304L stainless steel sheet formed by a semi-piercing process has regions of localized plastic deformation and material flow estimated to correspond to approximately 40% cold work at maximum. The resulting microstructures in the bulk (undeformed) and deformed regions were characterized by transmission electron microscopy prior to and following annealing treatments. The deformed region prior to annealing was observed to have complex microstructure consisting of γ phase and the strain induced martensitic phases, α' (bcc) and ϵ (hcp). Additionally, high densities of dislocations, stacking faults, and deformation twins were observed. Annealing at 450°C for 15 minutes resulted in little observed microstructural change. After 30 minutes at 750°C, considerable recrystallization and recovery was evident with substantial reversion of the martensitic phases. The residual banded microstructural features associated with the deformed structure were identified as twin related γ (fcc). Finally, annealing at 1050°C showed a completely recrystallized microstructure having large equiaxed grains, annealing twins, and a with very low dislocation density.

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Refer also to citation(s) 17896, 17897, 17904, 18229, 18584, 18677, 18798, 18829, 18874, 18880, 18892, 18905, 18984, 19368, 20346, 20349

18917 (AEA-FUS--84) **The effects of transmutation products on the radiation-induced swelling of Al_2O_3 and $MgAl_2O_4$.** Pells, G.P. (AEA Reactor Services, Harwell (United Kingdom)); Murphy, M.J. AEA Fusion, Culham (United Kingdom). Dec 1990. 22p. Order Number DE92627828. Source: OSTI; NTIS (US Sales Only); INIS.

In the absence of a high flux, fusion neutron source the effects of the major transmutation products hydrogen, helium and carbon on the swelling of polycrystalline Al_2O_3 and $MgAl_2O_4$ have been simulated for damage doses up to 20 dpa within the temperature range 535-1080 K. The samples were pre-implanted with H, He and C and subsequently irradiated with 4 MeV argon ions to give a transmutation product to damage dose ratio of 100 appm/dpa. The triple implants produced only a small increase in the volume swelling of alumina which did not exceed 15% of the swelling in non-implanted material under any irradiation conditions.The swelling in alumina varied as the damage dose to the power 0.36 for irradiation temperatures below 1080 K. After ≈1 dpa at 1080 K the exponent changed to 0.56 consistent with void swelling. In the case of $MgAl_2O_4$ spinel the triple pre-implants produced a large increase in volume swelling approximately doubling that for non-implanted spinel under all irradiation conditions. (author).

18918 (AEA-FUS--85) **Radiation-induced electrical conductivity in $MgAl_2O_4$ spinel.** Pells, G.P. (AEA Reactor Services, Harwell (United Kingdom)). AEA Fusion, Culham (United Kingdom). Dec 1990. 20p. Order Number DE92627829. Source: OSTI; NTIS (US Sales Only); INIS.

The d.c. electrical conductivity of high purity, polycrystalline $MgAl_2O_4$ spinel of 99.5% theoretical density has been measured during irradiation by 18 MeV protons at reactor relevant ionization dose rates. The radiation-induced conductivity (RIC) at 200 C varied in a slightly sub-linear manner with dose rate. At temperatures between 250-350 C the RIC varied in a complex manner with the dose rate dependence being itself dose rate dependent. At higher temperatures the RIC reverted to an essentially linear variation with dose rate. The complex dose rate dependence is ascribed to the magnesium vacancy concentration introduced by the small Al_2O_3 excess ($MgO:Al_2O = 1:1.05$) and the presence of anti-structure defects producing large concentrations of intrinsic electron and hole traps. There was no evidence that the accumulation of radiation damage influenced the details of radiation-induced conductivity and $MgAl_2O_4$ retained reasonable insulating properties at the highest dose rate and temperature. (author).

18919 (AEA-FUS--86) **Radiation-induced degradation of the electrical conductivity of $MgAl_2O_2$ and Al_2O_3.** Pells, G.P. (AEA Reactor Services, Harwell (United Kingdom)). AEA Fusion, Culham (United Kingdom). Dec 1990. 19p. Order Number DE92627830. Source: OSTI; NTIS (US Sales Only); INIS.

Polycrystalline $MgAl_2O_4$ and Al_2O_3 have been irradiated with 18 MeV protons at temperatures from 200-500 C while maintained in an electric field of 500 kV/m. Permanent increases in the d.c. conductivity occurred when the irradiation temperature exceeded 300 C for $MgAl_2O_4$ and 400 C for Al_2O_3 after an incubation dose that varied with both material and irradiation temperature. In the case of $MgAl_2O_4$ irradiation below 300 C and subsequent heating to 600 C also produced large increases in conductivity. Under extreme conditions the conductivity of both $MgAl_2O_4$ and Al_2O_3 increased to $\approx 10^{-4}\ \Omega^{-1}m^{-1}$ at which point the materials can no longer be regarded as good insulators. The damage dose required to produce severe degradation of the insulators is $\approx 10^{-3}$ dpa which would have severe consequences for ceramic insulated copper magnet coils located within the shield of a fusion power reactor. (author).

18920 (ANL/CP–73759) **Cluster assembly of hierarchical nanostructures.** Siegel, R.W. Argonne National Lab., IL (United States). Feb 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911202–68: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92010498. Source: OSTI; NTIS; GPO Dep.

In the past few years, atom clusters with diameters in the range of 2–20 nm of a variety of materials, including both metals and ceramics, have been synthesized by evaporation and condensation in high-purity gases and subsequently consolidated in situ under ultrahigh vacuum conditions to create nanophase materials. These new utirafine-grained materials have properties that are often significantly different and considerably improved relative to those of their coarser-grained counterparts owing to both their small grain-size scale and the large percentage of their atoms in grain boundary environments. Since their properties can be engineered during the synthesis and processing steps, cluster-assembled materials appear to have significant potential for the introduction of a hierarchy of both structure and properties. Some of the recent research on nanophase materials related to properties and scale are reviewed and some of the possibilities for synthesizing hierarchical nanostructures via cluster assembly are considered.

18921 (ANL/CP–75375) **Effect of metallic coating properties on the tribology of oil- lubricated coated-ceramics.** Ajayi, O.O.; Fenske, G.R.; Erdemir, A.; Erck, R.A.; Hsieh, J.H.; Nichols, F.A. Argonne National Lab., IL (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9205132–1: International conference on practical tribology, Moscow (USSR), 4-9 May 1992). Order Number DE92010904. Source: OSTI; NTIS; GPO Dep.

The friction and wear behavior of zirconia ceramics lubricated with solid coatings (AG, Au, and Nb), deposited by ion-beam-assisted-deposition (IBAD) techniques, and a polyol-ester-based synthetic oil are presented. These results demonstrate that, although the simultaneous use of soft (e.g. Ag and Au) solid lubricants in conjunction with the synthetic lubricant significantly reduces the friction and wear under boundary lubrication at temperatures up to 250°C, the durability of the soft films was poor. In contrast, durability of Nb coating (in terms of chemical reactivity and adhesion during the tribo-tests) was better than that of the Ag or Au films. However, the friction and wear behavior of the Nb-coated films was poorer than that of the ceramics coated with Ag or Au.

18922 (ANL/CP–75450) **Flux dynamics and irreversibility in $YBa_2Cu_3O_7$ with Y_2BaCuO_5 inclusions and in single crystal $YBa_2Cu_3O_7$.** Fossheim, K. (Norges Tekniske Hoegskole, Trondheim (Norway). Div. of Physics); Karkut, M.G.; Heill, L.K.; Slaski, M.; Sagdahl, L.T.; Vinokur, V.; Murakami, M.; Fujimoto, H.; Koshizuka, N.; Tanaka, S.; Gencer, F.; Abell, J.S.; Gough, C.E. Argonne National Lab., IL (United States). Jan 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9112107–1: Nobel jubliee symposium on low dimensional properties of solids, Gothenburg (Sweden), 4-7 Dec 1991). Order Number DE92009712. Source: OSTI; NTIS; GPO Dep.

We have measured the ac magnetic permeability response function $\mu = \mu' + i\mu''$ in melt-processed melt grown $YBa_2Cu_3O_7$ with Y_2BaCuO_5 inclusions (MPMG) and in single crystal $YBa_2Cu_3O_7$ (SC) in applied magnetic fields up to 8 Tesla oriented either parallel or perpendicular to the crystalline c-axis. The ac response of the two samples has been mapped out as a function of temperature, frequency, ac field amplitude, dc applied field, and field orientation. The peak in the lossy part of the susceptibility μ'' is used to probe the flux dynamics in the vicinity of the irreversibility line. The data are interpreted by comparison with expectations of an anisotropic vortex glass- to -liquid transition. The inferred melting lines as well as the frequency dependence and non-linear response are in overall agreement with the expected behavior. In the range of available parameters and variables we find the system to be in the solid vortex phase for $H \perp c$ since there is a strong H_{ac} dependence and only a weak frequency dependence on the temperature position of the loss peak. For $H \| c$, the situation is reversed, and the loss peak depends only weakly on H_{ac} and strongly on the frequency.

18923 (ANL/CP–75723) **First principles energetic calculations of sapphire (0001) and (1$\bar{1}$02) surfaces.** Guo, J.; Ellis, D.E.; Lam, D.J. Argonne National Lab., IL (United States). Mar 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;FG02-84ER45097. (CONF-9203110–1: 8. international conference on advanced science and technology, Argonne, IL (United States), 28 Mar 1992). Order Number DE92010908. Source: OSTI; NTIS; GPO Dep.

Various crystallographic faces of sapphire, the undoped single crystal α-Al_2O_3, have been widely used as substrates fro depositing thin films of metals, semiconductors, and insulators for basic scientific studies and for microelectronic applications. Epitaxial TiO_2 and VO_2 thin films were successfully grown on (0001), (1102) and (1120) surfaces of sapphire substrates by the Metal Organic Chemical Vapor Deposition (MOCVD) technique in our experimental program. The present paper is one of our theoretical efforts in parallel with the experimental program to gain microscopic understandings of the effects of substrate structure on the epitaxial relationship and the overlayer lattice structure of thin film deposition. The first principles energetic calculations on the complicated surfaces like sapphire can now be carried out because of the recent development in our computer programs and availability of high speed super computers. The phase first principles means that the calculations are based only on the know physical laws and approximations, and are free of any adjustable parameters. A complete discussion of the theoretical formalism has been presented in our previous works.

18924 (CONF-911202–72) **The oxidation stability of boron nitride thin films on MgO and TiO_2 substrates.** Qiu, Xiaomei (New Mexico Univ., Albuquerque, NM (United States)); Datye, A.K.; Paine, R.T.; Allard, L.F. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant CTS 8912366. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92011686. Source: OSTI; NTIS; GPO Dep.

The stability of BN thin film coatings (2–5 nm thick) on MgO and TiO2 substrates was investigated using transmission electron microscopy (TEM). The samples were heated in air for at least 16 hours at temperatures ranging from 773 K–1273 K. On MgO supports, the BN thin film coating was lost by 1073 K due to a solid state reaction with the substrate leading to formation of Mg2B2O5. No such reaction occurred with the TiO2 substrate and the BN was stable even at 1273 K. However, the coating appeared to ball up and phase segregate into islands of near-graphitic BN and clumps of TiO2 (rutile). The oxidizing treatment appears to promote the transformation from turbostratic BN to graphitic BN. 7 refs.

18925 (CONF-9203138–1) **Evaluation of dispersants for gelcasting.** Omatete, O.O.; Bleier, A. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering Foundation conference on dispersion aggregation; Palm Coast, FL (United States); 15-20 Mar 1992. Order Number DE92011803. Source: OSTI; NTIS; GPO Dep.

Dispersants were evaluated for producing fluid and pourable 50 vol % alumina slurries for use in aqueous gelcasting. The best dispersants are anionic polyelectrolytes with carboxylic acid sites. The major mechanism by which the anionic polyelectrolytes stabilize aqueous alumina suspensions is electrostatic. However, the presence of $Mg(NO_3)_2$, a precursor for MgO used as sintering aid for the alumina, and acrylamide monomer, used to form the gel, enhances the steric contribution of the adsorbed polymer to the interaction between alumina particles.

18926 (CRIE-W–90021) **Ceramic thermophysical properties and construction of database for high-temperature thermophysical properties for electric power plant.** Takahashi, T. (Central Reserach Institute of Electric Power Industry, Tokyo (Japan)). Central Research Inst. of Electric Power Industry, Tokyo

(Japan). May 1991. 22p. (In Japanese). Order Number DE92514552. Source: OSTI; NTIS (US Sales Only).

It is indispensible to use fine ceramics under high temperature condition for some parts of equipment of a new electric power generation system aiming at improvement of electric power generation efficiency. However, high-temperature thermophysical properties of ceramics required for design and development of the equipment are unexpectedly unknown. Therefore, high-temperature thermophysical properties of fine ceramics on the market are measured afresh, using the measuring instrument for thermophysical properties of ultra-high-temperature materials which is developed by Central Research Institute of Electric Power Industry and can be used for measurements up to 2000 °C. Then, the characteristic values obtained are databased. Using the above-mentioned instrument, high temperature thermophysical properties of three kinds of fine ceramics on the market are first made clear in the range up to ultra-high temperature. Constructed is database of thermophysical properties of electric power generating materials which can be used on various database management software for personal computers on the market. About 900 data mostly on ceramics and metal materials are now entered mainly as measured values. 13 figs., 9 tabs.

18927 (DOE/ER/13859–31) **Study of the surface properties of ceramic materials by chromatography: Final performance report.** Guiochon, G. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry. Mar 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13859. Order Number DE92011129. Source: OSTI; NTIS; GPO Dep.

Most fundamental research on adsorption assumes adsorbent surfaces to be homogeneous. Material chemists have been able to design and prepare a variety of adsorbents with a highly homogeneous surface. These adsorbents are widely used in chromatography and in adsorption studies, contributing to further anchor the idea that homogeneous surfaces are the most frequent case. In reality, many common materials used as finely divided powders such as pigments, fillers, ceramics, or involved in industrial procedures such as adhesion, have inhomogeneous surfaces, and this fact explains difficulties and troubles in predicting their properties and usefulness. The main result of work is a practical method which permits the detailed study of the chemical properties of non-homogeneous surfaces.

18928 (DOE/ER/45297–28) **Zinc substitution effects on the superconducting properties of $Nd_{1.85}Ce_{0.15}CuO_{4-\delta}$.** Garcia-Vazquez, V.; Mazumdar, S.; Falco, C.M.; Barlingay, C.; Risbud, S.H. Arizona Univ., Tucson, AZ (United States). [1990]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45297. (CONF-901291–3: Symposium on the manifestations of the electron-phonon interaction in copper oxides (CuO) and related superconductors, Oaxtepec (Mexico), 11-14 Dec 1990). Order Number DE92011461. Source: OSTI; NTIS; INIS; GPO Dep.

With the discovery of the electron superconductors, a new dimension was added to research in the field of high-temperature superconductivity. Studies of these materials should help elucidate the mechanism responsible for high-temperature superconductivity, as well as improve strategies for finding new superconductors. In this paper, we discuss the superconducting structural properties of $Nd_{1.85}Ce_{0.15}(Cu_{1-y}Zn_y)O_4$ as a function of the Zn concentration y. Detailed comparisons with previous results of similar substitution studies in the single-CuO_2-layer hole superconductor $La_{1.85}Sr_{0.15}CuO_4$ also are made. We have found that the non-magnetic element Zn has a detrimental effect on the T′-phase electron superconductor, and that this effect is as strong as in the T-phase hole superconductor. Theoretical implications and the question of electron-hole symmetry are also discussed.

18929 (DOE/ER/45309–4) **Ceramic surfaces and sintering: Final report, July 1, 1987–June 30, 1991.** Marks, L.D. Northwestern Univ., Evanston, IL (United States). Aug 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45309. Order Number DE92011570. Source: OSTI; NTIS; GPO Dep.

We produced ultrafine faceted alumina particles (UFPs), 20–50 nm in diameter, by an arc-discharge method and sintered small clusters of them as they were carried through a tube furnace by flowing gas. The experiment was conducted under near UHV clean environment and specimens were examined in a UHV H9000 TEM. The UFPs produced in this study were transition alumina phases ($\gamma\delta$ and θ). We found new δ and θ phases which were different from those in earlier studies. We developed two computer programs to simulate the shape, 3-D arrangement, and random contact of UFPs. Gaps were discovered to exist between particles due to random contact and possibly rotation and slip after contact. As no shrinkage was found, surface diffusion was identified as the dominant mechanism that was responsible for the formation of "necks" by filling in the gaps. These necks had well-defined, atomically-sharp contact angles, which suggest that the neck growth process was controlled by faceting.

18930 (DOE/ER/45372–4) **Energetics, bonding mechanism and electronic structure of metal/ceramic interfaces: Annual progress report, April 1, 1991–March 31, 1992.** Freeman, A.J. Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45372. Order Number DE92013401. Source: OSTI; NTIS; GPO Dep.

Among the tremendous variety of oxide materials currently used for technological applications, those based on titanium and vanadium oxides are not only among the most important, but are also the most intriguing. Relatively small changes in crystallographic modifications and valencies of metal atoms, as the wide class of Magnelli phases and related compounds, may result in abrupt metal-insulator transitions and sharp changes of magnetic ordering with critical temperatures that may vary in the hundreds of degrees range. When doped by other transition, or s and p metals, these oxides exhibit a vast variety of complicated cooperative phenomena,starting from unusual ferroelectricity up to superconductivity at moderately high temperatures. Most of these unusual materials have been extensively studied and used in the bulk or polycrystalline thin film form. For the fabrication of novel devices of micron or submicron sizes, however, single crystal films and superlattices are preferred or required. Moreover, one may expect that such "man-made" artificial structures will reveal new and unusual physical properties. These are the reasons for the Renaissance in experimental and theoretical investigations of these oxides that is now occurring.

18931 (DOE/ER/45394–3) **[Thermochemistry of phases related to oxide superconductors]: Progresss report.** Princeton Univ., NJ (United States). Dept. of Geological and Geophysical Sciences. [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER45394. Order Number DE92011811. Source: OSTI; NTIS; GPO Dep.

The aim of this project has been to understand the crystal-chemical and energetic constraints on the stability of phases related to oxide superconductors, using high temperature reaction calorimetry, the unique expertise of this laboratory, coupled with synthesis and structural studies. The YBCO (Y_2O_3-BaO-Cu-O) system has been studied in detail by Zhou for his Ph.D. thesis, while DiCarlo has been studying alkaline earth doped lanthanium cuprates of the series $La_{2-x}A_xCuO_{4-y}$ having structures related to K_2NiF_4.

18932 (INIS-mf–14056) **Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.** Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

The abstracts of 20 papers cover the following subject areas: Microfracture mechanisms in Al_2O_3 ceramics; modelling and measurement of the thermal shock behaviour of ceramics; fibre-reinforced carbon; preparation of super-conducting fibres consisting of Bi-Sr-Ca-Cu-oxide prepared by the glass-ceramics manufacturing route; high-temperature failure of vitrous bonded Al_2O_3; creep behaviour of whisker-reinforced oxide ceramics; platelet-reinforced mullite ceramics; effect of age-hardening on the mechanical behaviour and the microstructure of Y-doped Si_3N_4; methods of fatigue life prediction for ceramic materials. (MM).

18933 (INIS-mf–14056, pp. 1-4) **Microfracture mechanisms in Al_2O_3 ceramics.** Steinbrech, R.W. (Inst. fuer Reaktorwerkstoffe, Forschungszentrum Juelich GmbH (Germany)). Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991. 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). In *Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.* Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALUMINIUM OXIDES/crack propagation; FRACTURE MECHANICS

18934 (INIS-mf–14056, pp. 5-6) **Modelling and measurement of thermal shock behaviour of ceramics.** Pompe, W. (Max-Planck-Arbeitsgruppe Mechanik Heterogener Festkoerper, TU Dresden (Germany)); Bahr, H.A.; Schneider, G.; Weiss, H.J. Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991. 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). In *Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.* Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/thermal shock; CERAMICS; CRACK PROPAGATION; MEASURING METHODS; FRACTURE MECHANICS

18935 (INIS-mf–14056, pp. 29-31) **Fabrication of superconducting fibers of Bi-Sr-Ca-Cu oxide via the glass ceramics route.** Stieding, P. (Fachhochschule Nuernberg (Germany). Fachbereich Werkstofftechnik); Assmann, H.; Guenther, A. Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991. 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). In *Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.* Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

The following keywords describe the whole route from powder to ceramic fiber: (1) Mixing of the various constituents (Ga-, Bi-, Pb-, and Cu-oxide, as well as Sr- and Ca-carbonate). (2) Calcination in free air at 790deg C /10 h. (3) Fusion in free air at 1190deg C / approx. 4 h. (4) Preforming casting into a brass mold heated up to 300deg C. (5) Heat treatment of the preform at 375deg C. (6) Fiber drawing. (7) Crystallisation of fiber pieces in free air under a temperature programm. (orig.).

18936 (INIS-mf–14056, pp. 32-34) **High-temperature failure of vitreous bonded Al_2O_3.** Missbach, M. (Karlsruhe Univ. (T.H.) (Germany). Inst. fuer Zuverlaessigkeit und Schadenskunde im Maschinenbau); Fett, T.; Munz, D. Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991. 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). In *Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.* Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALUMINIUM OXIDES/failures; FAILURES; FRACTURE MECHANICS; SILICON OXIDES; CREEP; SERVICE LIFE; BENDING

18937 (INIS-mf–14056, pp. 48-49) **Methods for lifetime predictions of ceramic materials.** Mohrmann, R. (Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany)); Riedel, H.; Rombach, M. Deutsche Keramische Gesellschaft e.V. (DKG), Koeln (Germany). 1991. 53p. (In German). (CONF-9109375–: 5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting, Munich (Germany), 17 Sep 1991). In *Deutsche Keramische Gesellschaft e.V. Annual meeting 1991. Book of abstracts.* Order Number DE92516856. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/service life; CERAMICS/crack propagation; CERAMICS; FORECASTING; SILICON NITRIDES

18938 (INIS-SU–309/A, pp. 73-82) **HTGR fuel compositions.** Zelenskij, V.F. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Gurin, V.A.; Konotop, Yu.F.; Odejchuk, N.P.; Chajka, S.S.; Gozhenko, S.V.; Yakovlev, V.K.; Shirochenkov, S.D.; Evseev, V.M.; Borisenko, V.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Various methods for microsphere preparation are described in short. Some microsphere designs and material compositions for protective coatings providing efficient retention of gas fission product release are considered. The results of radiation tests of microfuel elements and ball fuel elements with a pyrocarbon binder manufactured on the basis of a variety of fuel compositions are presented. Behaviour of ball fuel elements with a pyrocarbon bond under inreactor irradiation is discussed. 7 refs.; 5 figs.

18939 (IS-T–1570) **Formation of high temperature superconductors from the solidified melt.** Merkle, B. Ames Lab., IA (United States). 3 Jan 1992. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012584. Source: OSTI; NTIS; GPO Dep.

The drop tube experiments with the $YBa_2Cu_3O_{7-\delta}$ (Y123) material have illustrated that the particle size, temperature and atmosphere during decomposition, melting and solidification is critical to the formation of the desired decomposition phases. Temperatures above 1450°C and small size, −75 +53 μm, particulate are necessary to produce complete decomposition of the Y123 and melting of all phases with the exception of Y_2O_3 (200). The importance of the atmosphere is demonstrated by the presence of the low P_{O2} stable $BaCu_2O_2$ (012) phase in the solidified spheres produced in a nitrogen atmosphere and the cubic phase (ϕ) in the solidified spheres produced in an oxygen atmosphere. The as solidified microstructure of the spheres where the liquids temperature was not obtained, are relatively similar. The major features of the phase composition and microstructure are primarily attributed to what happens upon heating and depend relatively little upon the solidification rate.

18940 (Juel–2523) **Development and characterization of HIP joining techniques for Si_3N_4 materials.** Sun Woo, J. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Angewandte Werkstofforschung; Technische Hochschule Aachen (Germany). Sep 1991. 141p. (In German). Order Number DE92511502. Source: OSTI; NTIS (US Sales Only); INIS.

The report deals with the development and optimization of reproducible techniques for joining Si_3N_4 with Si_3N_4 without interlayers consisting of other materials, applying hot isostatic pressing and vacuum plasma spraying. Furthermore, experiments are reported that have been performed in addition to the above-mentioned, for preparing Si_3N_4 sintered specimens without sintering additives, applying the HIP technique. The resulting specimens have been tested for their joining characteristics, which are reported. All reported experiments have been performed varying essential parameters such as HIP temperature, pressure, holding time, surface roughness, and heat treatment. Every parameter has been examined individually for its effect on the bonding strength of the prepared Si_3N_4-Si_3N_4 joint, applying 4P bending tests at room temperature and at 1200deg C. (orig./MM).

18941 (Juel–2560) **Physical and chemical properties of $YBa_2Cu_3O_7$ thin films.** El-Samahi, M.I. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany). Dec 1991. 112p. Order Number DE92511439. Source: OSTI; NTIS (US Sales Only); INIS.

Investigations were carried out to determine the influence of different annealing processes on the superconducting properties of the $YBa_2Cu_3O_7$ thin films. The samples were produced by means of coevaporation of Cu, Y and Ba on polycrystalline yttria stabilized (YSZ) ZrO_2 and single crystal $SrTiO_3$ (001) substrates. Subsequently, the as-deposited films were subjected to two different annealing methods to crystallize the superconducting phase $YBa_2Cu_3O_7$: (i) heating up, annealing and cooling in an oxygen atmosphere and (ii) heating up in an innert gas atmosphere up to the maximum annealing temperature (T_{max}) and then annealing and cooling under oxygen. (orig.).

18942 (KCP-613-4650) **Titanium carbon nitride coating: Final report.** Nance, S.D. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92013158. Source: OSTI; NTIS; GPO Dep.

The purpose of this investigation was to determine the advantages of titanium carbon nitride (TiCN) coated tools. Cutting tests were conducted comparing TiCN coating directly against titanium nitride (TiN) coated and uncoated T-15 CPM end mills.

18943 (KFK-4940) **Evaluation of R-curves in ceramic materials based on bridging interactions.** Fett, T.; Munz, D. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Oct 1991. 44p. Order Number DE92511506. Source: OSTI; NTIS (US Sales Only); INIS.

In coarse-grained alumina the crack growth resistance increases with increasing crack extension due to crack-border interactions. The crack shielding stress intensity factor can be calculated from the relation between the bridging stresses and the crack opening displacement. The parameters of this relation can be obtained from experimental results on stable or subcritical crack extension. Finally the effected of the R-curve on the behaviour of components with small cracks is discussed. (orig.).

18944 (LA-UR-92-706) **Magnetic hysteresis and relaxation in Ag-sheathed TlBaCaCuO (1223) and Bi(Pb)SrCaCuO (2223) superconducting tapes.** Kung, P.J. (Los Alamos National Lab., NM (United States)); Maley, M.P.; Coulter, J.Y.; Willis, J.O.; Peterson, D.E.; McHenry, M.E.; Wahlbeck, P.G. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920240-4: High T_cSUH workshop on high temperature superconductivity (HTS) materials, bulk processing and bulk applications, Houston, TX (United States), 27-28 Feb 1992). Order Number DE92011357. Source: OSTI; NTIS; GPO Dep.

Magnetic hysteresis (7–75 K in magnetic fields up to 5 T) and relaxation characteristics (5–50 K in magnetic fields up to 2 T) have been measured with the field perpendicular to the surface of Ag-sheathed TlBaCaCuO (1223 phase) and Bi(Pb)SrCaCuO (2223 phase) superconducting tapes. A study of the difference in the magnetic hysteresis between precursor powders and as-processed tapes was also carried out. The relaxation data were curve-fit using a rate equation for thermally activated flux motion, $U_{eff}/[kG(T)] = -T[\ln(dM/dt) - \ln(H\omega_o\ a/2\pi d)]$ with the temperature dependence of U_{eff} scaled by the functional form $G(T) = 1 - (T/Tx)^2$. By comparing the results obtained from magnetic characterization with those from transport current measurement, these observations suggest that (1) Tl-1223 tapes have a weaker field dependence for J_c at T > 35 K than Bi-2223 tapes due to the special crystal structure of the 1223 phase, and (2) weak links limit the transport critical current densities in Tl-1223 tapes to 10^3 A/cm^2 at 5 T and 35 K, for instance.

18945 (LA-UR-92-1426) **Electron microscopy study on zirconia and alumina ceramic powders synthesized by microwave plasma pyrolysis.** Sickafus, K.E. (Los Alamos National Lab., NM (United States)); Varma, R.; Vollath, D. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920402-2: Material Research Society spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92013385. Source: OSTI; NTIS; GPO Dep.

Morphology, chemistry and microstructure of zirconia and alumina based ceramic powders synthesized by microwave plasma pyrolysis were studied by transmission electron microscopy. Electron diffraction was used to determine the phases present, while conventional bright field and dark field imaging were used to characterize grain size and density variations. Materials analyzed in this study were either pure zirconia, pure alumina, or a ternary zirconia-yttria-alumina oxide. Solid spheres, hollow spheres, and fragments of hollow spheres were observed. All three modifications of zirconia were observed in the pure zirconia powder. In alumina, the predominant phase was cubic, gamma alumina. In the ternary oxide, most structures exhibited cubic zirconia diffraction patterns. Energy dispersive x-ray spectroscopy revealed chemical inhomogeneities in the ternary oxide powder.

18946 (LA-UR-92-1435) **Microstructure and properties of in-situ rf sputtered $YBa_2Cu_3O_7$ thin films for microwave applications.** Reagor, D.W. (Los Alamos National Lab., NM (United States)); Houlton, R.J.; Garzon, F.H.; Hawley, M.; Raistrick, I.D.; Piza, M.E. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920402-3: Material Research Society spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92013379. Source: OSTI; NTIS; GPO Dep.

The residual surface resistance of a number of films of $YBa_2Cu_3O_7$, prepared by off-axis sputtering onto MgO substrates, has been measured using parallel-plate resonator technique. Deposition conditions were kept constant, apart from the substrate temperature. There is no correlation between surface resistance and other important microscopic parameters, such as T_c and c-axis lattice parameter. There is, however, a trend to higher R_s with increasing volume fraction of in-plane misoriented material, although the correlation is not perfect. Furthermore, we have found that most of the misoriented material is localized at the film substrate interface and therefore is probably not responsible for most of the RF losses. The data suggest that at higher deposition temperatures, there is an increasing tendency for 45°-misoriented material to appear in the films, and it may be that a significant fraction of this material is present closer to the free film surface. STM qualitatively supports this conclusion.

18947 (LBL-31456) **Scintillation properties of lead sulfate.** Moses, W.W. (Lawrence Berkeley Lab., CA (United States)); Derenzo, S.E.; Shlichta, P.J. Lawrence Berkeley Lab., CA (United States). Nov 1991. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Health and Human Services, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant P01-HL25840;Grant R01-CA48002. (CONF-911106-89: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92010301. Source: OSTI; NTIS; INIS; GPO Dep.

We report on the scintillation properties of lead sulfate ($PbSO_4$), a scintillator that show promise as a high energy photon detector. It physical properties are well suited for gamma detection, as its has a density of 6.4 gm/cm^3, a 1/e attenuation length for 511 keV photons of 1.2 cm, is not affected by air or moisture, and is cut and polished easily. In 99.998% pure $PbSO_4$ crystals at room temperature excited by 511 keV annihilation photons, the fluorescence decay lifetime contains significant fast components having 1.8 ns (5%) and 19 ns (36%) decay times, but with longer components having 95 ns (36%) and 425 ns (23%) decays times. The peak emission wavelength is 335 nm, which is transmitted by borosilicate glass windowed photomultiplier tubes. The total scintillation light output increases with decreasing temperature fro 3,200 photons/MeV at +45°C to 4, 900 photons/MeV at room temperature (+25°C) and 68,500 photons/MeV at −145°C. In an imperfect, 3 mm cube of a naturally occurring mineral form of $PbSO_4$ (anglesite) at room temperature, a 511 keV photopeak is seen with a total light output of 60% that BGO. There are significant sample to sample variations of the light output among anglesite samples, so the light output of lead sulfate may improve when large synthetic crystals become available. 10 refs.

18948 (MLM-3735) **Surface chemistry of BORAZON: I, Analysis of the three cubic boron nitride materials: Type 1, 510, and 550.** Moddeman, W.E.; Foose, D.S.; Bowling, W.C.; Burke, A.R.; Kasten, L.S.; Cassidy, R.T. Mound, Miamisburg, OH

(United States). 25 Mar 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-88DP43495. Order Number DE92012411. Source: OSTI; NTIS; GPO Dep.

Auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS) were used to characterize the surface chemistry of three BORAZON* materials: Type I, 510, and 550. Samples were examined in the "as-received" condition and following heat treatments in air. Boron oxides were found on the Type I and 550 BORAZON crystals; oxide thicknesses were estimated to be 15A. The titanium-coated product, 510, was found to have a discontinuous titanium coating with a TiO_2 layer that was approximately 20A thick. Following heat treatment at 800°C for 1 hr in air, the boron oxide layer on the Type I crystals was found to increase in thickness to approximately 30A. The same heat treatment on the 510 crystals yielded a multi-layered structure consisting of an enriched outer layer of B_2O_3 over a predominantly TiO_2 one. The entire initial titanium coating was oxidized, and segregated patches of B_2O_3 ("islands") were observed. The segregated patches can be explained in terms of the coalescence of liquid B_2O_3 (melting point = 450°C). The 550 crystals were oxidized at 500°C. The oxide formed at this temperature was B_xO ($x > 0.67$). These results were interpreted in terms of their potential use in sealing BORAZON to glass in vitreous bonding.

18949 (NEI-DK-794) **Surface studies of $YBa_2Cu_3O_{7-x}$ -matching oxide substrates and interfaces.** Enevold Thaulov Andersen, J. Copenhagen Univ. (Denmark). H.C. Oersted Inst. Nov 1990 99p. Order Number DE92627809. Source: OSTI; NTIS (US Sales Only); INIS.

Crystallographic changes as a result of heat-treatment at 700-900 deg. C are found for $SrTiO_3$(100), MgO(100) and $LaAlO_3$(100). The p(2x2) reconstruction of the $SrTiO_3$(100) and the superstructures on MgO(100) and on $LaAlO_3$(100) thus observed are suggested to be induced by segregation of impurities to the surface. The surface charge-effects which disturb electron- and photon-impact experiments with these insulators are removed by heat-treatments. Deposition of copper results in formation of copper islands on $SrTiO_3$(100) and on $LaAlO_3$(100). Yttrium forms islands on $LaAlO_3$(100) and grows in a layer-by-layer mode on $SrTiO_3$(100) and on MgO(100). An yttrium 1x1 epitaxy is observed on the MgO(100) surface, which is suggested to be an YO superstructure. Oxidation of the 1x1 Y/MgO(100) systems diminishes the charge-effects and improves all diffraction and spectroscopic measurements. This may be due to the formation of metallic states around the Fermi level when the film is oxidized. An in situ synthesized $YBa_2Cu_3O_7$ thin film on $SrTiO_3$(100) compared to a thick epitaxial $YBa_2Cu_3O_{7-x}$(001) film on MgO(100) reveals differences in surface electronic structures but not in surface stoichiometries. (au) 18 refs.

18950 (SAND-92-0864C) **Thermally activated rejuvenation of ferroelectric properties in electrically fatigued lead zirconate titanate ceramics.** Pan, W.Y. (New Mexico Inst. of Mining and Technology, Socorro, NM (United States). Dept. of Metallurgical and Materials Engineering); Yue, C.F.; Lin, K.W.; Tuttle, B.A. Sandia National Labs., Albuquerque, NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920445-1: 25. anniversary meeting of the Dielectric Society with the 2nd European conference on applications of polar dielectrics and international workshop on integrated ferroelectrics, London (United Kingdom), 12-15 Apr 1992). Order Number DE92012634. Source: OSTI; NTIS; GPO Dep.

Thermally activated rejuvenation of ferroelectric properties is investigated for modified lead zirconate titanate ferroelectric ceramics that have been electrically fatigued. The extent of rejuvenation for the ferroelectric polarization increases with both increasing temperature and increasing time of the post-fatigue thermal anneal. For an insufficient post-fatigue thermal anneal, the ferroelectric ceramic sample exhibits incomplete restoration of ferroelectric properties and an increased fatigue rate compared to the virgin sample. Complete rejuvenation of ferroelectric properties occurs when the fatigued ferroelectric ceramic is thermally annealed well above the ferroelectric-paraelectric phase transition temperature for many hours. The thermal rejuvenation of fatigue is explained by the thermally stimulated decoupling between the spontaneous polarization and either defects or space charge.

3606 Other Materials

Refer also to citation(s) 17924, 17926, 17951, 17992, 18002, 18067, 18074, 18239, 18240, 18241, 18242, 18408, 18409, 18892, 18905, 18911, 18932, 19019, 19038, 19120, 19133, 19140, 19146, 19339, 19952, 20349, 20436, 20437

18951 (ANL/CP-74502) **Time-dependent behavior of concrete.** Pfeiffer, P.A. (Argonne National Lab., IL (United States)); Tanabe, Tada-aki. Argonne National Lab., IL (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9204108-1: 10. American Society of Civil Engineers (ASCE) structures congress, San Antonio, TX (United States), 13-15 Apr 1992). Order Number DE92010514. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is a condensed version of the material presented at the International Workshop on Finite Element Analysis of Reinforced Concrete, Session 4 – Time Dependent Behavior, held at Columbia University, New York on June 3–6, 1991. Dr. P.A. Pfeiffer presented recent developments in time-dependent behavior of concrete and Professor T. Tanabe presented a review of research in Japan on time-dependent behavior of concrete. The paper discusses the recent research of time-dependent behavior of concrete in the past few years. 6 refs.

18952 (ANL/CP-75282) **Poly(lactic acid) degradable plastics, coatings, and binders.** Bonsignore, P.V.; Coleman, R.D.; Mudde, J.P. Argonne National Lab., IL (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9205133-1: 1992 technical Association of Pulp and Paper Manufacturers (APPM) conference, Marcos Island, FL (United States), 11-13 May 1992). Order Number DE92010903. Source: OSTI; NTIS; GPO Dep.

Biochemical processes to derive value from the management of high carbohydrate food wastes, such as potato starch, corn starch, and cheese whey permeate, have typically been limited to the production of either ethanol or methane. Argonne National Laboratory (ANL) believes that lactic acid presents an attractive option for an alternate fermentation end product, especially in light of lactic acids' being a viable candidate for conversion to environmentally safe poly(lactic acid) (PLA) degradable plastics, coatings, and binders. Technology is being developed at ANL to permit a more cost effective route to modified high molecular weight PLA. Preliminary data on the degradation behavior of these modified PLAs shows the retention to the inherent hydrolytic degradability of the PLA modified, however, by introduced compositional variables. A limited study was done on the hydrolytic stability of soluble oligomers of poly(L-lactic acid). Over a 34 day hold period, water-methanol solutions of PI-LA oligomers in the 2-10 DP range retained some 75% of their original molecular weight.

18953 (ANL/CP-75684) **Radiolytic gas production in the alpha particle degradation of plastics.** Reed, D.T. (Argonne National Lab., IL (United States)); Hoh, J.; Emery, J.; Hobbs, D. Argonne National Lab., IL (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920307-72: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011846. Source: OSTI; NTIS; INIS; GPO Dep.

Net gas generation due to alpha particle irradiation of polyethylene and polyvinyl chloride was investigated. Experiments were performed in an air environment at 30, 60, and 100°C. The predominant radiolytic degradation products of polyethylene were hydrogen and carbon dioxide with a wide variety of trace organic species noted. Irradiation of polyvinyl chloride resulted in the formation of HCl in addition to the products observed for polyethylene. For both plastic materials, a strong enhancement of net yields was noted at 100°C.

18954 (CONF-9105202-, pp. 4, Paper 3) **Searching for new compounds: 'Quantum architecture' of novel metals and semiconductors.** Zunger, A. (National Renewable Energy Lab., Golden, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Simple semiconductors such as Si, Ge, GaP, GaAs, InP, and AlAs have traditionally been used as core materials for a wide range of electronic and optoelectronic devices. It has hence been a common practice to form solid solutions (of composition x) A_xB_{1-x} of the parent compounds A and B, attempting thereby to obtain technologically useful material properties that are intermediate between those of pure of A and pure B. Unlike the parent crystalline semiconductors A and B, however, the alloys A_xB_{1-x} are disordered, and hence generally have lesser electron mobility, and are structurally unstable toward low-temperature disproportionation into their binary constituents. Until recently, it was believed that all such isolvalent semiconductor alloys between A and B exist either as disproportionation products of A + B, or as disordered solid solutions A_xB_{1-x}. More recently the authors has predicted theoretically that hitherto unknown, long-range, ordered stoichiometric intersemiconductor compounds A_nB_m can be thermodynamically more stable than the disordered alloy below some growth temperature T_c. Such ordered compounds for a novel class of semiconductors in that their crystal structures are unprecedented in conventional semiconductor physics; their band structures differ both from the average of the constituents and from those of disordered alloy. Many of them are thermodynamically more stable than the disordered alloy of the same composition; some are even more stable than the phase-separated systems. Since the authors original prediction, more than 20 observations of such long-range ordered, intersemiconductor compounds have been made. It now appears that this phenomenon of long-range, ordered, inter-semiconductor phases is likely to be the rule rather than the exception in semiconductor physics. A similar situation exists in metal physics: a new compounds were so far difficult to predict.

18955 (CONF-9105202–, pp. 6, Paper 14) **Ab initio calculations of properties of crystals, surfaces, and materials under pressure.** Louie, S.G. (Univ. of California, Berkeley (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC03-76SF00098. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Advances in theory and the availability of supercomputers have made possible the computation of material properties from first principles. With only information on the constituent atoms, calculations have been carried out to explain and predict the structure and the electronic, optical, structural, mechanical, and superconducting properties of variety of systems including bulk crystal, surfaces and interfaces, semiconductor superlattices, small clusters, and new phases of materials under high pressures. Since much of the progress in materials/solid state sciences and in technology depends on new materials and on understanding materials under extreme conditions, a predictive theory for materials is of fundamental and technological importance. In particular, first principles calculations are of great value in exploring novel materials and systems such as surfaces and interfaces for which often only limited experimental data are available. In this paper, the author briefly discusses some of the recent progress in theory and some results from selected applications. The cohesive and structural properties of semiconductors and insulators are determined using a variational quantum Monte Carlo approach; the electron excitation spectra of the Si(111) 2x1 reconstructed surface are calculated using the quasiparticle self energy approach; and the behavior of solid molecular hydrogen under megabar pressures is investigated. An accurate treatment of the many-electron effects arising from the strong Coulomb interaction between electrons is shown to be important for quantitative results.

18956 (DOE/ER/12119–1) **Synthesis of new high performance lubricants and solid lubricants: Progress report, June 1991–March 1992.** Lagow, R.J. Texas Univ., Austin, TX (United States). Dept. of Chemistry. Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER12119. Order Number DE92011940. Source: OSTI; NTIS; GPO Dep.

We have started to make a number of classes of new perfluoropolyethers both in the solid lubricant area and liquid lubricant area. We have prepared some chlorofluoroethers for testing as additives for normal petroleum and polyalphaolefin lubricants which are so widely used in the United States. Perfluoropolyethers are not soluble in hydrocarbons. On the other hand, these chlorofluoropolyethers are soluble in substantial amounts in simple hydrocarbons. These are uniquely capable of being additives that flow with the motor oil or the polyalphaolefin.

18957 (DOE/ER/13403–4) **Perforated monolayers: Progress report, July 1, 1991–Mar 31, 1992.** Regen, S.L. Lehigh Univ., Bethlehem, PA (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13403. Order Number DE92011632. Source: OSTI; NTIS; GPO Dep.

Our research over this past grant period has focused on (1) developing methods for making in situ permeation measurements at the air-water interface, (2) defining the structural and conformational behavior of selected calix[4]arenes, (3) defining the metal complexation properties of certain upper-rim functionalized calix[4]arenes, and (4) synthesizing a broad series of polymerizable calixarenes, to be used for constructing perforated monolayers and multilayers.

18958 (DOE/ER/13711–5) **Mechanical properties and modeling of seal-forming lithologies: Technical progress report No. 2, March 15, 1991–March 14, 1992.** Kronenberg, A.K.; Russell, J.E.; Carter, N.L.; Ibanez, W.; Mazariegos, R. Texas A and M Univ., College Station, TX (United States). Center for Tectonophysics. Apr 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER13711. Order Number DE92012597. Source: OSTI; NTIS; GPO Dep.

Both rocksalt and shale lithologies are actively deformed in response to gravitational loads associated with deposition, and both form effective seals to petroleum and natural gas. Thus, the shapes of seal-forming units, and the nature of fractures and faults that may breach them depend upon either the mechanical properties of salt or those of shale, and the loading histories to which they have been subjected. The objectives of this research include the determination of the mechanical properties under controlled conditions of well-characterized shales, and the numerical modeling of rocksalt (and eventually shale) formations using laboratory-based rheologies. Progress has been made towards these goals over this project period, both in our experimental program on shale deformation and model development for the growth of salt diapirs. The mechanical anisotropy of an illite-bearing shale from Louisiana has been determined and related to the preferred orientation and distribution of clays. Its strength in the absence of pore fluids has been determined at confining pressures of up to 250 MPa and at high pressure we have investigated the effects of deformation rate and temperature. A numerical finite difference code has been developed to solve the incompressible Navier-Stokes equations and validated using a two- layer linear viscous model for which analytic solutions are available. Although the code has only been validated for the linear viscous case, it is capable of solving for highly nonlinear constitutive laws as well as solving for arbitrary interfaces between the salt and overburden.

18959 (DOE/ER/45375–T1) **Segmental interpenetration at polymer interfaces: [Progress report].** Russell, T.P.; Fleming, W.W. IBM Research Div., San Jose, CA (United States). Almaden Research Center. [1989]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER45375. Order Number DE92012600. Source: OSTI; NTIS; GPO Dep.

During the first year of this proposal significant strides have been made in understanding the nature of the interface in symmetric, diblock copolymers and the nature of the interface formed between immiscible homopolymers. Emphasis has been placed on the symmetric, diblock copolymers of polystyrene (PS) and polymethylmethacrylate (PMMA) since these diblock copolymers and the corresponding homopolymers are available over a wide range of molecular weight with narrow molecular weight distributions. In addition, the homopolymers and copolymers can be obtained with different levels of deuteration. Thus, these materials form a model system by which systematic studies on the interfacial behavior of homopolymers and block copolymers can be performed.

18960 (DOE/ER/45419–2) **Role of structure in ion movement of glasses: Progress report, January 14, 1991–January 15, 1992.** Jain, Himanshu. Lehigh Univ., Bethlehem, PA (United States). 15 Jan 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45419. Order Number DE92011751. Source: OSTI; NTIS; GPO Dep.

Can the structure of a melt much above the glass transition temperature (Tg) determine the structure and (transport) properties of glass? In other words, are there extremely long lasting configurations in a melt which would affect ion transport in the glassy state? A major effort during the past year has been to address these very fundamental questions. An important consideration here is to separate the effect of the variable melt structure from that of a variable cooling rate in the glass transformation range. For this reason our experiment consists of preparing 0.3 Na_2O–0.7 B_2O_3 glasses from the melt which is first equilibrated at 1400 C and then annealed at 850 C for 0 to 180 minutes. From 850 C variously annealed melts are quenched to the glassy state by following identical procedure. If the structure (as reflected in ion transport) of 1400 C melt relaxes to that of 850 C in ~ minutes, we may expect to observe variations in the conductivity time in the ns range.

18961 (FEI–2167) **Thermal and chemical effect of burning sodium on concretes.** Drobyshev, A.V.; Burakov, B.G.; Kulikov, E.V.; Sosnina, E.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1991. 65p. (In Russian). Order Number DE92625763. Source: OSTI; NTIS (US Sales Only); INIS.

Structural concrete behaviour under burning sodium effect is investigated. The analysis conducted shows that the foured out sodium contains two danger for concretes-thermal and chemical ones. Resulting from sodium effect on concretes based on Portland cement, hydrogen production an concrete destruction take place as a rule. To reduce the danger of concrete structure destruction under contact with sodium it is proposed to investigate cncretes based on aluminous cements or magnesite ones with vermiculite or carbon fillers. 18 refs.; 10 figs.; 11 tab.

18962 (INIS-mf–13159, pp. 48-52) **Experience with the evaluation of the radiation and thermal stability of cables for WWER nuclear power plants.** Cizek, Z. (Skoda, Plzen (Czechoslovakia). Ustredni Vyzkumny a Zkusebni Ustav); Kubes, Z. Ceska Vedeckotechnicka Spolecnost, Ceske Budejovice (Czechoslovakia). Dum Techniky. 1989. 162p. (In Czech). (CONF-8909472–: National seminar on degradation of nuclear power plant materials by the working environment, Cesky Krumlov (Czechoslovakia), 28-29 Sep 1989). In *Degradation of nuclear power plant materials by the working environment.* Order Number DE92625598. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of the experiments was to evaluate the properties of cables, particularly of the plastics used for insulation, and their changes induced by short, high-intensity radiation exposure and by long, low-intensity heat and radiation exposure. Samples of 17 different cables were irradiated in a training reactor and subsequently subjected to microscopic observation, metallographic examination, infrared spectroscopic investigation and tensile testing. A minor (10-20%) decrease in strength took place in the majority of cables. Changes in ductility of the exposed sheathing were more marked. All the cables tested satisfy the basic radiation stability requirements. (M.D.). 12 refs.

18963 (INIS-mf–13192, pp. 256) **Effect of reactor neutrons on physical properties of semiconductors.** Mudron, J. (Vysoka Vojenska Technicka Skola, Liptovsky Mikulas (Czechoslovakia). Katedra Fyziky); Sutta, P.; Macko, L.; Macko, P. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SEMICONDUCTOR MATERIALS/physical radiation effects; ELECTRIC CONDUCTIVITY; FAST NEUTRONS

18964 (INIS-mf–13192, pp. 260) **The study of radiation effects in metallic glasses by positron annihilation.** Macko, L. (Vysoka Vojenska Technicka Skola, Liptovsky Mikulas (Czechoslovakia). Katedra Fyziky); Sutta, P.; Mudron, J.; Miglierini, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. METALLIC GLASSES/physical radiation effects; ANNIHILATION; LIFETIME; NEUTRONS; POSITRONS

18965 (INIS-SU–309/A, pp. 134-141) **Regularities of structural changes and localization of implanted atoms in ion-irradiated semiconductors of A^3B^5 type.** Deev, A.S. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Grinchenko, A.Yu.; Olejnik, V.A.; Svetashov, P.A.; Skakun, N.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Structural changes and localization of impurity atoms in a lattice were established by the use of backscattering of protons and helium ions, resonant nuclear reactions and the effect of channeled particle flux redistribution. Presented are the experimental data on the quantity, type and space distribution of radiation defects in InP, InAs and InSb crystals irradiated with ions of deuterium, helium, beryllium, boron, carbon, nitrogen, oxygen, fluorine and magnesium. Evidence is obtained for a regular localization of the second-period atoms of the periodic table in the lattice of A^3B^5 compounds. 6 refs.; 10 figs.; 1 tab.

18966 (KCP–613-4504) **Interface friction, lubricants, and their influence on metal flow: Progress report 2.** El-Gizawy, A.S. (Missouri Univ., Columbia, MO (United States). Dept. of Mechanical Aerospace Engineering). Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Mar 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012112. Source: OSTI; NTIS; GPO Dep.

In precision forging, interface friction between the workpiece and the die has a significant effect on material flow and the character of die filling. Hot forming lubricants differ dramatically in their ability to reduce friction and aid die filling depending on the temperature at which they are used and the material being forged. The ring compression test was used to evaluate a variety of lubricants at a number of temperatures. The test involves forging a flat ring. The change in internal diameter during reduction in ring height provides a sensitive measure of interface friction. Fortran programs were developed to predict the variation in the internal diameter of the rings with the percentage of height reduction for different friction factors. Friction factors estimated by evaluation of the exact energy balance equation were reported to be most accurate and were recommended as better than previously published calibration curves.

18967 (KCP–613-4661) **High density thin-walled syntactic foam: Final report.** Staggs, W.A. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92013159. Source: OSTI; NTIS; GPO Dep.

Silicone rubber/glass microballoon syntactic foams (0.64 g/cm^3) were prepared using two different silicone rubber resin systems. Physical and thermodynamic properties were characterized for both syntactic foam systems. The mold was modified, and mold filling and handling techniques were varied to reduce the number and size of voids.

18968 (KFK–4969) **Fracture behavior of polymers at low temperatures.** Saatkamp, T. Kernforschungszentrum Karlsruhe

GmbH (Germany). Inst. fuer Materialforschung; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Maschinenbau. Dec 1991. 88p. (In German). Order Number DE92511574. Source: OSTI; NTIS (US Sales Only); INIS.

The crack propagation behavior of polymers at cryogenic temperatures is determined by the physical processes taking place at the crack tip. It is demonstrated in this paper that stable or unstable crack growth does not depend on the experimental setup, but on the properties of the polymers. The plastification processes at the crack tip are both temperature and time dependent. The critical energy release rate G_{IC} was measured for three polymers, namely semi-crystalline HDPE, amorphous PS and amophous PC, as a function of the crack opening velocity δ at 4.2 and 77 K, respectively. During unstable crack growth, a crack arrest behavior (stick-slip behavior) caused by adiabatic heating and plastification at the crack tip can be observed in most of the polymers. The little specific heat and thermal conductivity of polymers at cryogenic temperatures lead to considerable temperature increases even at small inelastic deformation energies. Under certain conditions, the increase in temperature is sufficient to attain the dispersion range of the second glass transition, as a result of which plastification is intensified. During these processes, the fracture energy R and, hence, the critical energy release rate G_{IC} are increased considerably. (orig.).

18969 (LA-UR--91-3097) **The comparative effects of gamma radiation and in situ alpha particles on five strong-base anion exchange resins.** Marsh, S.F. Los Alamos National Lab., NM (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920703--1: International conference on ion exchange advances, Cambridge (United Kingdom), 12-17 Jul 1992). Order Number DE92000177. Source: OSTI; NTIS; INIS; GPO Dep.

The effects of external gamma radiation and in situ alpha particles were measured on a recently available, macroporous, strong-base polyvinylpyridine resin and on four strong-base polystyrene anion exchange resins. Each resin was irradiated in 7 M nitric acid to 1--10 megaGray of gamma radiation from external ^{60}Co, or to 5--14 megaGray of alpha particles from sorbed ^{238}Pu. Each irradiated resin was measured for changes in dry weight, wet volume, weak-base and strong-base chloride exchange capacities, and exchange capacities for Pu(4) from nitric acid. Alpha-induced resin damage was significantly less than that caused by an equivalent dose of gamma radiation. The polyvinylpyridine resin offers the greatest resistance to damage from gamma radiation and from alpha particles. 5 refs., 1 figs. 5 tabs.

18970 (LA-UR--92-748) **Synthesis and characterization of a covalently bound self-assembled macrocycle monolayer thin film for nonlinear optical materials.** Li, DeQuan; Swanson, B.I.; Robinson, J.M.; Hoffbauer, M.A. Los Alamos National Lab., NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920124--20: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92011353. Source: OSTI; NTIS; GPO Dep.

Synthesis and characterization of covalently bound self-assembled, 5,10,15,20-Tetra(4-pyridyl)-21H,23H-porphine monolayer superlattices on various oxide surfaces such as fused silica, glass or silicon are described. The mono-molecular??? thin film structures are characterized by UV-visible (λ_{max} = 447 nm) and FTIR-ATR spectroscopy. In addition, X-ray photoelectron spectroscopy and secondary ion mass spectroscopy studies are used to confirm the formation of a self-assembled monolayer on the fused-silica surface. Attractive features in these complexes are their second-order nonlinear optical properties, enhanced by the completely delocalized π-electrons. Second harmonic generation measurements have been used to determine the uniformity of the film, the relative and absolute magnitudes of nonzero elements of the nonlinear susceptibility, $\chi^{(2)}$, and the average molecular orientation of the chromophores.

18971 (LA-UR--92-1370) **A perspective on $MoSi_2$ based composites.** Petrovic, J.J. (Los Alamos National Lab., NM (United States)); Vasudevan, A.K. Los Alamos National Lab., NM (United States). [1992]. 12p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920402--4: Material Research Society spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92013434. Source: OSTI; NTIS; GPO Dep.

$MoSi_2$ based composites represent an important new class of "high temperature structural silicides," with significant potential for elevated temperature structural applications in the range of 1200--1600°C in oxidizing and aggressive environments. The properties of $MoSi_2$ which make it an attractive matrix for high temperature composites are described and the development history of these materials traced. Latest results on elevated temperature creep resistance, low temperature fracture toughness, and composite oxidation behavior are summarized. Important avenues for future $MoSi_2$ based composite development are suggested.

18972 (MLM--3737) **Timer cover adhesive optimization.** Carleton, J.J. II. Mound, Miamisburg, OH (United States). 17 Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-88DP43495. Order Number DE92012412. Source: OSTI; NTIS; GPO Dep.

The implementation of PROCODE as the data acquisition system for processing timers has required some modifications to the method of identifying timer assemblies. PROCODE requires machine-readable labelling of the assemblies. This report describes a series of experiments to find an adhesive that would keep labels attached to timers regardless of the condition of their surface when the label was applied and regardless of the heat, vibration, and shock they endured afterwards. The effect of the variation of these experimental factors on the performance of the adhesive was determined by using a Taguchi experimental design.

18973 (PNL-SA--20358) **Electronic structure and photophysical properties of polyimides.** LaFemina, J.P. (Pacific Northwest Lab., Richland, WA (United States)); Kafafi, S.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920444--27: American Chemical Society national meeting, San Francisco, CA (United States), 5-10 Apr 1992). Order Number DE92012353. Source: OSTI; NTIS; GPO Dep.

The quantum mechanical AM1 and CNDO/S3 models were used to examine the effect of isoelectronic substitutions on the conformation, electronic structure, and optical absorption spectra for a series of aromatic polyimides. An analysis of the geometric changes at the substitution site and its effect on the electronic structure allowed for the prediction of changes in the ICT band of the optical absorption spectra.

18974 (SAND--91-1591) **Characterization of polymers for microcellular foams.** Schneider, D.A.; Assink, R.A. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012444. Source: OSTI; NTIS; GPO Dep.

We have measured, by ^{1}H and ^{13}C nuclear magnetic resonance (NMR), the percent deuteration, the tacticity and the purity of several polymers and one solvent used in the preparation of microcellular foams. The percent deuteration was measured for polystyrene, polyacrylonitrile and polyethylene. The tacticities of polystyrene and polyacrylonitrile were determined. The purity and degradation products of polyacrylonitrile and maleic anhydride were examined. This report documents the experimental procedures and results of these measurements.

18975 (SAND--91-2693C) **A comparison of interstital oxygen calculated by different techniques.** Medernach, J.W.; Stevenson, J.O. Sandia National Labs., Albuquerque, NM (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920514--3: 181. meeting of the Electrochemical Society, Inc., St. Louis, MO (United States), 17-22 May 1992). Order Number DE92011658. Source: OSTI; NTIS; GPO Dep.

Methods which report an ability to determine interstitial oxygen (O_i) in heavily doped silicon include the short baseline (SBL) and the curved baseline (CBL) techniques. Both the SBL and CBL methods are similar with the exception of the calibration. We developed a FORTRAN software package to provide separate methods for calculating O_i. The strength of the software is its ability to rapidly compare methods. We report on a comparison of calculation methods including the ASTM standard test F1188-88 which is used in a calibration, and the SBL and the CBL methods, which are used for the heavily doped silicon to provide reliable results. The O_i values calculated for both virgin and thermally processed silicon are reported.

18976 (SAND–91-2727C) **Raman features of CVD diamond films.** Alam, M. (New Mexico Inst. of Mining and Technology, Socorro, NM (United States)); Tallant, D.R.; Peebles, D.E. Sandia National Labs., Albuquerque, NM (United States). [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9203124–1: 3. annual diamond technology workshop, Detroit, MI (United States), 17-18 Mar 1992). Order Number DE92011381. Source: OSTI; NTIS; GPO Dep.

There is considerable interest in the use of chemically vapor deposited (CVD) polycrystalline diamond films in advanced materials technology. However, most of the potential applications of CVD diamond films require well-controlled properties which depend on the film structure, and in turn, on the conditions under which the films are synthesized. The structure of the vapor-deposited diamond films is frequently characterized by Raman spectroscopy. Despite extensive research, much work still needs to be completed to understand the various features of the Raman spectra and to understand how the processing variables affect the spectral features. This paper examines the Raman spectra of diamond films prepared by a hot-filament-assisted CVD process as a function of substrate processing and deposition parameters.

18977 (SAND–92-0384C) **Growth and optical characterization of $Zn_{1-x}Mn_xTe$ grown by molecular beam epitaxy.** Reno, J.L.; Jones, E.D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920676–1: Electronic materials conference, Cambridge, MA (United States), 24-26 Jun 1992). Order Number DE92010667. Source: OSTI; NTIS; GPO Dep.

We have grown $Zn_{1-x}Mn_xTe$ alloys by molecular beam epitaxy and characterized them using x-ray diffraction and low temperature magnetoluminescence. $Zn_{1-x}Mn_xTe$ is a dilute magnetic semiconductor (DMS) whose bandgap ranges from the green through the blue part of the spectrum and is therefore of interest for blue LEDs.

18978 (SAND–92-0393C) **Perspectives of ion implantation for optics.** Arnold, G.W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9206141–1: 1992 Optics international conference, Padova (Italy), 9-12 Jun 1992). Order Number DE92010664. Source: OSTI; NTIS; GPO Dep.

Energetic ions incident on insulators produce refractive-index changes as a result of damage, compound formation, or phase separation. These alterations allow waveguides to be formed in crystals and glasses. Non-linear optical properties allow second-harmonic generation in waveguides in crystals (e.g., quartz) and intensity-dependent refractive index changes due to metal colloids implanted into glass. Waveguide lasers have been realized by MeV He beam formation of guides in rare-earth containing materials and by direct implantation of rare-earths into waveguides regions. Hardness changes in glasses result from implantation-induced surface stresses and from crystallization.

18979 (STRIPA-TR–91-21) **Superplasticizer function and sorption in high performance cement based grouts.** Onofrei, M. (AECL Research, Whiteshell Laboratories, Pinawa, MB (Canada)); Gray, M.N.; Roe, L.H. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Aug 1991. 90p. Order Number DE92627833. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes laboratory studies undertaken to determine interactions between the main components of high-performance cement-based grout. These interactions were studied with the grouts in both their unset and hardened states with the specific intention of determining the following: the mechanistic function of superplasticizer; the phase of residence of the superplasticizer in hardened materials; and the permanence of the superplasticizer in hardened grouts. In unset pastes attempts were made to extract superplasticizer by mechanical processes. In hardened grout the superplasticizer was leached from the grouts. A microautoradiographic method was developed to investigate the phases of residence of superplasticizer in hardened grouts and confirm the inferences from the leaching studies. In hardened grout the superplasticizer was located on the hydrated phases formed during the early stages of cement hydration. These include tricalcium aluminate hydrates and tricalcium silicate phases. There is some tendency for the superplasticizer to sorb on ettringite. The presence of superplasticizer did not coincide with the locations of unreacted silica fume and high silica content phases such as C_2S-H. The observations explain the findings of the studies of unset pastes which also showed that the sorption of superplasticizer is likely to be enhanced with increased mixing water content and, hence, distribution in and exposure to the hydration reaction surfaces in the grout. Superplasticizer can be leached in very small quantities from the hardened grouts. Rapid release takes place from the unsorbed superplasticizer contained in the accessible pore space. Subsequent release likely occurs with dissolution of the cement phases and the exposure of isolated pores to groundwater. (au) (37 refs.).

18980 (STRIPA-TR–91-24) **Theoretical investigations of grout seal longevity.** Alcorn, S.R. (RE/SPEC Inc., Albuquerque, NM (United States)); Coons, W.E.; Christian-Frear, T.L.; Wallace, M.G. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1991. 37p. Order Number DE92627834. Source: OSTI; NTIS (US Sales Only); INIS.

Theoretical investigations into the longevity of repository seals have dealt primarily with the development of a methodology to evaluate interactions between portland cement-based grout and groundwater. Groundwater travel times through a seal have been calculated based on Darcy's Law, with an assumed hydraulic gradient for the site and initial hydraulic conductivity for the grout. Chemical interactions between a model grout and actual groundwater compositions have been evaluated by means of geochemical modelling codes. Changes in grout porosity derived from the geochemical modelling have been extended to yield estimates of hydraulic conductivity, based on published experimental results. Also, a preliminary approach to the evaluation of the role of diffusion processes in grout alteration has begun. Results of these investigations suggest that cement grout seals will maintain an acceptable level of performance for tens of thousands to millions of years, provided the repository is sited where groundwater chemistry is compatible with the seals and hydrologic gradients are low. (au) (21 refs.).

18981 (UCRL-ID–109373) **Cursory examination of the zeta potential behaviors of two optical materials.** Tesar, A. (Lawrence Livermore National Lab., CA (United States)); Oja, T. Lawrence Livermore National Lab., CA (United States). 2 Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011588. Source: OSTI; NTIS; GPO Dep.

When an oxide surface is placed in water, a difference in potential across the interface occurs due to dipole orientation. Hydroxyl groups or bound oxygen atoms on the oxide surface will orient adjacent water molecules which balance the dipole charge. This occurs over some small distance called the electrical double layer. Trace amounts of high field strength ions present in the vicinity of the double layer can have significant effects on the double layer. When there is movement of the oxide surface with respect to the water, a shearing of the double layer occurs. The electrical potential at this surface of shear is termed the zeta potential. The impetus for this study was to document the zeta potential behavior in water of two optical materials. (1) a multicomponent phosphate glass; and (2) Zerodur, a silicate glass-ceramic.

18982 (UCRL-JC–104516) **Mechanical structure-property relationships of microcellular, low density foams.** LeMay, J.D. Lawrence Livermore National Lab., CA (United States). Nov 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract W-7405-ENG-48. (CONF-901105–135: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 24 Nov - 1 dec 1990). Order Number DE92011390. Source: OSTI; NTIS; GPO Dep.

High energy physics applications at the Department of Energy National Laboratories require unique low-density foams of demanding homogeneity specifications (cell sizes on the order of 10 μm or smaller). These delicate and fragile foams are machined and shaped into specimens to exacting tolerances. In this work, the mechanical properties of a variety of these low density microcellular foams are reported as functions of foam density and morphology.

18983 (UCRL-JC–105233) **Quantitative non-destructive environmental characterization of advanced materials.** Dobie, D.; Celeste, J.; Krauter, G. Lawrence Livermore National Lab., CA (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910399–7: American Society for Nondestructive Testing spring conference, Oakland, CA (United States), 18-22 Mar 1991). Order Number DE92011462. Source: OSTI; NTIS; GPO Dep.

Polymethylpentene, polystyrene, agar, carbon, and composites, are advanced materials that have unique engineering properties. Of particular interest to our engineering department is their response to temperature and humidity excursions. We built computer-controlled environmental test chambers to evaluate the materials and derive thermal and hygroscopic (water absorption) properties.

18984 (UCRL-JC–107317) **Toughened moderate-temperature cure exoxy structural adhesives.** LeMay, J.D.; Lyon, R.E. Lawrence Livermore National Lab., CA (United States). Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9205146–1: 6. international symposium on structural adhesive bonding, Morristown, NJ (United States), 4-7 May 1992). Order Number DE92011962. Source: OSTI; NTIS; GPO Dep.

Low-viscosity liquid precursor adhesives that can be cured at moderate temperatures and deliver high static strength and fracture toughness in bonded joints are of interest in a variety of structural joining applications at Lawrence Livermore. We have developed a toughened, structural epoxy adhesive that cures completely at 75°C and has a fracture toughness, K_{Ic}(joint)=1.3 MPa$\sqrt{m}$, in a 100μm thick bondline. This adhesive is based on diglycidylether of bisphenol-A (DGEBA) epoxide resin in combination with an amidoamine hardener, and is toughened with an epoxide-functional liquid rubber. This adhesive was developed to join beryllium oxide components, but has proven to be a good general purpose structural adhesive for a variety of high surface energy substrates including metals, metal oxide ceramics, and glasses. The low surface tension of the liquid adhesive, γ=31 dynes/cm, ensures that it also will wet and bond most low surface energy solids such as plastics and fiber reinforced polymer composites.

18985 (UCRL-JC–108738) **Transient photoconductivity of low temperature GaAs grown by molecular beam epitaxy terahertz radar applications.** Morse, J.D.; Mariella, R.P. Jr.; McConaghy, C.F. Lawrence Livermore National Lab., CA (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911267–3: DARPA/Rome laboratory symposium on photonics systems for antenna applications, Monterey, CA (United States), 10-12 Dec 1991). Order Number DE92011848. Source: OSTI; NTIS; GPO Dep.

Optoelectronic sampling techniques have been utilized to characterize transient photoconductivity in low temperature (LT) GaAs grown by molecular beam epitaxy (MBE). Metal-semiconductor-metal (MSM) photoconductive devices have been fabricated on LT-GaAs layers grown at a "calibrated" substrate temperature of 190°C. Results from on-chip photoconductive sampling measurements demonstrate the ability to generate, propagate, and detect photocurrent pulses of ~4ps duration, which is limited by the optoelectronic measurement system. A carrier mobility of 120 cm^2/V-s has been estimated from these results, which is a factor of 5–10 times larger than alternative materials used for picosecond photoconductivity. This translates to improved sensitivity for emission and detection of terahertz pulses of electromagnetic (EM) radiation. 10 refs.

18986 (UCRL-JC–110152) **Sol-gel multilayers applied by a meniscus coating process.** Britten, J.A.; Thomas, I.M. Lawrence Livermore National Lab., CA (United States). 19 Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920402–1: Material Research Society spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92012697. Source: OSTI; NTIS; GPO Dep.

We describe a meniscus coating method to produce high-laser damage threshold, silica/alumina sol-gel multilayer reflectors on 30 + cm substrates for laser-fusion applications. This process involves forcing a small suspension flow through a porous applicator tube, forming a falling film on the tube. A substrate contacts this film to form a meniscus. Motion of the substrate relative to the applicator entrains a thin film on the substrate, which leaves behind a porous, optical quality film upon solvent evaporation. We develop a solution for the entrained film thickness as a function of geometry, flow and fluid properties by an analysis similar to that of the classical dip-coating problem. This solution is compared with experimental measurements. Also, preliminary results of multilayer coating experiments with a prototype coater are presented, which focus on coating uniformity and laser damage threshold (LDT).

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18987 (ANL–91/42) **Nuclear technology programs: Semiannual progress report, October 1989–March 1990.** Harmon, J.E. (ed.). Argonne National Lab., IL (United States). Jan 1992. 209p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013641. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports on the work done by the Nuclear Technology Programs of the Chemical Technology Division, Argonne National Laboratory, in the period October 1989–March 1990. These programs involve R&D in three areas: applied physical chemistry, separation science and technology, and nuclear waste management. The work in applied physical chemistry includes investigations into the processes that control the release and transport of fission products under accident-like conditions, the thermophysical properties of metal fuel and blanket materials of the Integral Fast Reactor, and the properties of selected materials in environments simulating those of fusion energy systems. In the area of separation science and technology, the bulk of the effort is concerned with developing and implementing processes for the removal and concentration of actinides from waste streams contaminated by transuranic elements. Another effort is concerned water waste stream generated in production of 2,4,6-trinitrotoluene. In the area of waste management, investigations are underway on the performance of materials in projected nuclear repository conditions to provide input to the licensing of the nation's high-level waste repositories.

18988 (CONF-920761–9) **Small scale trace element zonations in carbonates: An ion microprobe study of diagenesis in the upper Devonian Nisku Formation, Western Canada Sedimentary Basin.** Riciputi, L.R. (Oak Ridge National Lab., TN (United States)); Cole, D.R.; Christie, W.H.; Rosseel, T.M.; Machel, H.G. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92011042. Source: OSTI; NTIS; GPO Dep.

Trace element contents of carbonates contain important information regarding the sample's diagenetic history. However, due to the fine scale and intergrown nature of many carbonate textures, separation of the different phases of bulk analysis is difficult or impossible. Analytical techniques have been developed using the ion microprobe that allow the analysis of a variety of trace elements in spots of 10 to 20 microns in diameter, at detection limits of 1 ppm or lower. The utility of this technique is demonstrated in a study of diagenetic carbonates from the Nisku Formation in the Western Canada Sedimentary Basin.

18989 (ENEA-RT-INN--90-12) **XeCl laser fluorosensor for spectral and time resolved measurements.** Barbini, R.; Fantoni, R.; Palucci, A.; Ribezzo, S.; van der Steen, H.J.L. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione. May 1991. 41p. (RT/INN--90-12). Order Number DE92506290. Source: OSTI; NTIS (US Sales Only); INIS.

An excimer laser based LIDAR fluorosensor, designed for airborne operation, has been assembled at the ENEA (Italian National Agency for New Technologies, Energy and Environment) Centre in Frascati and laboratory measurements on different samples have been performed. Laser induced fluorescence and Raman signals from both liquid and solid targets were detected with the capability of wavelength and time resolution. Results obtained in present preliminary laboratory experiments are being discussed with respect to the identification and quantitative analysis of oil pollutants on sea water and to the probing of vegetation both on land and in the sea.

18990 (ETDE-IT--92-19) **Coherent anti-stokes raman studies of UV laser induced gas phase dissociation of benzene.** Fantoni, R.; Giorgi, M.; Lipinska-Kalita, K.E.; Moliterni, A.G. ENEA, Frascati (Italy). 1992. 2p. (CONF-920872--2: 13. international conference on Raman spectroscopy, Wuerzburg (Germany), 31 Aug - 4 sep 1992). Order Number DE92506220. Source: OSTI; NTIS (US Sales Only).

Non-linear Raman spectroscopies, including CARS, are valuable on-line techniques in the study of laser induced processes. This paper reports on the application of the CARS technique in studies of two gas phase systems, C_6H_6-N_2 and C_6H_6-O_2, during UV laser irradiation. Particular care was taken to measure the parent dissociation and identify the primary and secondary fragments. Under collisional conditions in the C_6H_6-N_2 mixture, it was found that C_2 in different electronically excited states is produced by two photon laser photolysis at 266 nm in direct parent fragmentation. Together with a scarcely attenuated CARS peak of C_6H_6 (v1), resonantly enhanced CARS bands of C_2 were observed. In the case of UV dissociation of the C_6H_6-O_2 mixture, nearly all the C_6H_6 was decomposed in a single shot and narrow features located on the slope of the broad 470 nm band, assigned to transitions in the Swan's band of C_2 photofragments, were detected.

18991 (INFO--0211) **Development of an automated method for determination of thorium in soil samples and aerosols.** Stuart, J.E. (Becquerel Laboratories Inc. (Canada)); Robertson, R. Atomic Energy Control Board, Ottawa, ON (Canada). Sep 1986. 28p. Order Number DE92625302. Source: OSTI; NTIS (US Sales Only); INIS.

Methodology for determining trace thorium levels in a variety of sample types was further developed. Thorium in filtered water samples is concentrated by ferric hydroxide precipitation followed by dissolution and co-precipitation with lanthanum fluoride. Aerosols on glass fibre, cellulose ester, or teflon filters and solid soil and sediment samples are acid digested. Subsequently thorium is concentrated by lanthanum fluoride co-precipitation. Chemical separation and measurement is then done on a Technicon AA11-C autoanalyzer, using solvent extraction into thenoyltrifuoroacetone in kerosene followed by back extraction into 2 N_HNO_3, and colourometric measurement of the thorium arsenazo III complex. Chemical yields are determined by the addition of thorium-234 tracer using gamma-ray spectrometry. The sensitivities of the methods for water, aerosol and solid samples are approximately 1.0 μg/L, 0.5 μg/g and 1.0 μg/g respectively. At thorium levels about ten times the detection limit, accuracy is estimated to be ± 10% for liquids and aerosols and ± 15% for solid samples, and precision ± 5% for all samples.

18992 (INIS-mf--13192, pp. 31-32) **Elemental analysis of high-volume samples of mineral origin using radiative capture and inelastic neutron scattering.** Pospisil, S. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska); Janout, Z.; Konicek, J.; Vobecky, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The experimental setup of the irradiation facility, the spectrometer unit and the analytical method are described, and the results are summarized obtained in application of the method to the determination of technologically important elements in coal (Fe, S, Si, C) and in nickel ores and chromium ores. Measurements based on the radiative capture of slow neutrons were accomplished using a ^{252}Cf source exhibiting a total neutron emission of $2.5x10^7$ s^{-1}, whereas analyses based on the inelastic scattering of fast neutrons employed a ^{241}AmBe source with a total emission of $2.4x10^7$ s^{-1}. In the analyses of coal employing the (n,γ) process, the detection limits for the determination of Fe, S and Si were 0.34%, 0.64% and 1.3% rel., respectively; when using the $(n,n'\gamma)$ process, the detection limits for Si and C were 0.9% and 3.3%, respectively. The investigation of nickel and chromium ores was based on the (n,γ) process, and the detection limits were 0.20% for Ni and 0.25% for Cr. The methods in question have the following assets: the method is nondestructive and contactless, analytical information can be obtained immediately during the irradiation of a relatively large amount of sample (about 100 kg), the method is highly selective with respect to many elements contained in mineral materials and it is fairly sensitive, and the limits of determination are sufficiently low. (Z.S.). 4 refs.

18993 (INIS-mf--13192, pp. 245) **Ion beam analysis of materials.** Dobrovodsky, J. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta); Hozza, V.; Kovac, P.; Necas, V.; Pavlovic, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PIXE ANALYSIS; HELIUM IONS; ION BEAMS; KEV RANGE 100-1000; PROTON BEAMS

18994 (INIS-mf--13192, pp. 245) **PIXE analysis of thick samples.** Havranek, V. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Hnatowicz, V.; Kvitek, J.; Obrusnik, I. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PIXE ANALYSIS/calibration; CALIBRATION

18995 (INIS-mf--13192, pp. 248) **Nitrogen and oxygen determination by non-Rutherford proton scattering.** Havranek, V. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Hnatowicz, V.; Kvitek, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NITROGEN/elastic scattering; OXYGEN/elastic scattering; CHEMICAL ANALYSIS; CROSS SECTIONS; NITROGEN; OXYGEN; PROTONS; SENSITIVITY

18996 (INIS-SU--305/A, pp. 298) **Extraction-X-ray fluorescence determination of aluminium in alloys of nonferrous metal alloys.** Lobanov, F.I. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)); Zebreva, A.I.; Andreeva, N.N.; Ivanova, N.V.; Filippova, L.M. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ALUMINIUM/x-ray fluorescence analysis; ALUMINIUM; ALUMINIUM COMPLEXES; CARBOXYLIC ACIDS; COPPER ALLOYS; DISTRIBUTION FUNCTIONS; HDEHP; MIXTURES; NICKEL ALLOYS; PH VALUE; SENSITIVITY; SOLVENT EXTRACTION; ZINC ALLOYS

18997 (INIS-SU–305/A, pp. 279) **Sulfur-containing analogs of mono- and polynuclear phenols as extraction-photometric reagents.** Alekperov, R.A. (AN Azerbajdzhanskoj SSR, Baku (USSR). Inst. Neorganicheskoj i Fizicheskoj Khimii); Mamedov, M.M.; Ramazanova, R.S.; Mamedov, I.M. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. MOLYBDENUM COMPLEXES/solvent extraction; TELLURIUM COMPLEXES/solvent extraction; TUNGSTEN COMPLEXES/solvent extraction; VANADIUM COMPLEXES/solvent extraction; CHEMICAL COMPOSITION; PHOTOMETRY; THIOPHENOLS

18998 (INIS-SU–305/A, pp. 280) **Scandium extraction with diethylaminomethylalizarin.** Babushkin, V.A. (Permskij Gosudarstvennyj Univ., Perm (USSR)); Barmina, G.A.; Sarana, I.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. SCANDIUM/quantitative chemical analysis; SCANDIUM COMPLEXES/photometry; SCANDIUM COMPLEXES/solvent extraction; AMINES; ANTHRAQUINONES; HYDROXY COMPOUNDS; INTERFERING ELEMENTS; PH VALUE; REAGENTS; SCANDIUM; PHOTOMETRY; SOLVENTS

18999 (INIS-SU–305/A, pp. 281) **Extraction of elements with biscarbocyanine dyes.** Balog, I.S. (Uzhgorodskij Gosudarstvennyj Univ., Uzhgorod (Ukraine)). AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. MOLYBDENUM COMPLEXES/photometry; MOLYBDENUM COMPLEXES/solvent extraction; TRANSITION ELEMENTS/quantitative chemical analysis; ZIRCONIUM COMPLEXES/photometry; ZIRCONIUM COMPLEXES/solvent extraction; CHEMICAL COMPOSITION; CYANINE DYES; PHOTOMETRY; ORGANIC SOLVENTS; THIOCYANATES

19000 (INIS-SU–305/A, pp. 278) **Extraction of cerium carbonate and sulfate complexes.** Shevchuk, I.A. (Donetskij Gosudarstvennyj Univ., Donetsk (Ukraine)); Simonova, T.N.; Khoda Mussa, M.; Rokun, A.N.; Zubritskij, M.Yu. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CERIUM COMPLEXES/solvent extraction; ACID CARBONATES; ALKALI METAL COMPOUNDS; AMINES; AQUEOUS SOLUTIONS; CARBONATES; CHEMICAL REACTION KINETICS; COORDINATION VALENCES; ORGANIC SOLVENTS; SULFATES; SULFURIC ACID

19001 (INIS-SU–305/A, pp. 284) **Extraction of different-ligand complexes of tantalum (5), titanium (4) and vanadium (5) with rhodanide ion and 1-(2-methylphenoxy)-3-(N-morpholino)-propanol-2.** Verdizade, N.A. (Azerbajdzhanskij Gosudarstvennyj Pedagogicheskij Inst., Baku (USSR)); Amrakhov, T.I.; Khalilova, N.K.; Shiralieva, S.M.; Shamilov, Kh.Kh.; Mamedova, R.K.; Kuliev, S.N. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. TANTALUM/quantitative chemical analysis; TANTALUM COMPLEXES/organic solvents; TANTALUM COMPLEXES/solvent extraction; VANADIUM/quantitative chemical analysis; VANADIUM COMPLEXES/organic solvents; VANADIUM COMPLEXES/solvent extraction; CHEMICAL COMPOSITION; INTERFERING ELEMENTS; MORPHOLINES; PH VALUE; PROPANOLS; QUANTITY RATIO; TANTALUM; THIOCYANATES; TITANIUM COMPLEXES; VANADIUM

19002 (INIS-SU–305/A, pp. 289) **Inversion-voltammetric method for vanadium (5) determination in the presence of vanadium (4) and Cu^{2+} with the use of electromembrane extraction.** Dubova, N.M. (Tomskij Politekhnicheskij Inst., Tomsk (USSR)); Karavaeva, T.A.; Kaplin, A.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. VANADATES/quantitative chemical analysis; VANADATES/separation processes; ALTERNATING CURRENT; COPPER COMPOUNDS; ELECTROPHORESIS; ION EXCHANGE MATERIALS; MEMBRANES; PH VALUE; POLAROGRAPHY; VALENCE; VANADATES

19003 (INIS-SU–305/A, pp. 290) **Extraction separation of matrix during metallic tungsten analysis.** Evseeva, N.K. (AN SSSR, Chernogolovka (USSR). Inst. Fiziki Tverdogo Tela); Turanov, A.N. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. TUNGSTEN COMPLEXES/solvent extraction; DISTRIBUTION FUNCTIONS; EMISSION SPECTROSCOPY; IMPURITIES; PH VALUE; POLYSTYRENE-DVB; QUATERNARY COMPOUNDS; TRACE AMOUNTS; TUNGSTEN

19004 (INIS-SU–305/A, pp. 294) **Scandium extraction by extractant mixtures and its analytical application.** Zebreva, A.I. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)); Lobanov, F.I.; Manuilova, O.A.; Andreeva, N.N. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. SCANDIUM/radiometric analysis; SCANDIUM/x-ray fluorescence analysis; SCANDIUM COMPLEXES/solvent extraction; AMINES; CARBOXYLIC ACIDS; HDEHP; MIXTURES; PH VALUE; QUANTITY RATIO; SCANDIUM; SENSITIVITY; TBP

19005 (INIS-SU--305/A, pp. 297) **Extraction-photometric determination of main components of HTSC materials.** Kremenskaya, I.N. (AN SSSR, Chernogolovka (USSR). Inst. Fiziki Tverdogo Tela); Putrya, L.V.; Turanov, A.N. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. STRONTIUM COMPLEXES/photometry; STRONTIUM COMPLEXES/solvent extraction; YTTRIUM COMPLEXES/photometry; YTTRIUM COMPLEXES/solvent extraction; BARIUM OXIDES; BISMUTH OXIDES; CALCIUM OXIDES; COPPER OXIDES; DISTRIBUTION FUNCTIONS; HIGH-TC SUPERCONDUCTORS; PH VALUE; QUANTITY RATIO; REAGENTS; PHOTOMETRY; STRONTIUM OXIDES; TBP; YTTRIUM OXIDES

19006 (INIS-SU--305/A, pp. 302) **Use of interligand and intermetal exchange in extraction-photometric simultaneous determination of metals.** Per'kov, I.G. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Burak, P.I.; Drozd, A.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CADMIUM/quantitative chemical analysis; CADMIUM COMPLEXES/photometry; CADMIUM COMPLEXES/solvent extraction; CADMIUM; PHOTOMETRY; DITHIZONE; OXINE; PAN; TRANSITION ELEMENT COMPOUNDS; WASTE WATER; ZINC COMPOUNDS

19007 (INIS-SU--305/A, pp. 301) **Extraction of anionic vanadium chelate compounds with bromopyrogallic red.** Pastare, S.Ya. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)); Rudzit, G.P.; Vyatere, A.Ya. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. VANADIUM COMPLEXES/solvent extraction; CHELATES; GUANIDINES; ORGANIC BROMINE COMPOUNDS; ORGANIC SOLVENTS; PH VALUE; POLYPHENOLS; TETRAZOLIUM

19008 (INIS-SU--313, pp. 78-81) **Comparative evaluation of sample pretreatment for radiochemical determination of cesium radioisotope specific activity.** Tamulenajte, O.P.; Dauskurdis, S.I. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Comparison of three methods of sample pretreatment when determining the specific activity of cesium isotopes in veterinary supervision products (grass, different types of fodder, human foodstuffs, etc.), including calcination by burning, wet calcination and direct dissolution, is presented. It is shown that the best method of sample preparation is the method of direct dissolution. In this case the carrier yield-stable cesium - is close to 100 % practically in all cases. 4 refs.; 1 tab.

19009 (IS-M--686) **Real-time infrared spectroscopy of moving solids for on-line analyses.** Jones, R.W.; Luo, S.; McClelland, J.F. Ames Lab., IA (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-9109297--2: 8. international conference on fourier tranform spectroscopy, Lubeck-Travemunde (Germany), 1-6 Sep 1991). Order Number DE92012156. Source: OSTI; NTIS; GPO Dep.

Two related methods, transient infrared emission spectroscopy and transient infrared transmission spectroscopy, can obtain good spectra from opaque, moving solids by using a transient thermal gradient to isolate spectroscopically a thin layer of material. The basic elements of the methods, the ability to depth profile, and an application involving monitoring coating cure are described. 4 refs.

19010 (NPL-RSA(EXT)--20) **Environmental radioactivity measurement intercomparison exercise 1990.** Jerome, S.M. (National Physical Lab., Teddington (United Kingdom). Div. of Radiation Science and Acoustics). National Physical Lab., Teddington (United Kingdom). May 1991. 39p. Order Number DE92625278. Source: OSTI; NTIS (US Sales Only); INIS.

In a recent national intercomparison exercise, 49 laboratories involved in making environmental radioactivity measurements took part in the analysis of samples supplied by the National Physical Laboratory (NPL) in the United Kingdom. There were two sets of samples; one containing pure β-emitters and one containing β/γ-emitters. Two thirds of the participants measured the β/γ-emitter sample only, the remainder measured both. The results are presented. (author).

19011 (SAND--92-8495C) **Saturation effects in degenerate four-wave mixing spectroscopy: Nonperturbative calculations.** Lucht, R.P.; Farrow, R.L.; Rakestraw, D.J. Sandia National Labs., Livermore, CA (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920573--8: CLEO/QELS '92, Anaheim, CA (United States), 10-17 May 1992). Order Number DE92012253. Source: OSTI; NTIS; GPO Dep.

Saturation, collisional, and Doppler effects for gas-phase degenerate four-wave mixing (DFWM) are investigated through nonperturbative solution of the density matrix equations. The calculated lineshapes and pressure dependence are in excellent agreement with nitric oxide DFWM experiments.

19012 (WSRC-MS--90-85) **Automated spike preparation system for Isotope Dilution Mass Spectrometry (IDMS).** Maxwell, S.L. III; Clark, J.P. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9007106--91: 31. Institute of Nuclear Materials Management (INMM) conference, Los Angeles, CA (United States), 15-18 Jul 1990). Order Number DE92011119. Source: OSTI; NTIS; INIS; GPO Dep.

Isotope Dilution Mass Spectrometry (IDMS) is a method frequently employed to measure dissolved, irradiated nuclear materials. A known quantity of a unique isotope of the element to be measured (referred to as the "spike") is added to the solution containing the analyte. The resulting solution is chemically purified then analyzed by mass spectrometry. By measuring the magnitude of the response for each isotope and the response for the "unique spike" then relating this to the known quantity of the "spike", the quantity of the nuclear material can be determined. An automated spike preparation system was developed at the Savannah River Site (SRS) to dispense spikes for use in IDMS analytical methods. Prior to this development, technicians weighed each individual spike manually to achieve the accuracy required. This procedure was time-consuming and subjected the master stock solution to evaporation. The new system employs a high precision SMI Model 300 Unipump dispenser interfaced with an electronic balance and a portable Epson HX-20 notebook computer to automate spike preparation.

19013 (Y/DK–883) **Characterization of polychlorinated biphenyl congeners and isomers in commercial Aroclor mixtures.** Smyrl, N.R.; Hembree, D.H. Jr.; Williams, D.M. Oak Ridge Y-12 Plant, TN (United States). 26 Feb 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-920302–6: 43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA (United States), 9-13 Mar 1992). Order Number DE92011887. Source: OSTI; NTIS; GPO Dep.

A new instrument combining infrared and mass spectrometry to simultaneously examine the effluent from a single capillary column gas chromatographic injection has been constructed from separate commercial instrument components. Gas chromatography/mass spectrometry (GC/MS) is performed in the conventional manner. The Fourier transform infrared (FTIR) portion of the instrument employs a new technology involving low-temperature deposition of the eluting compounds from the gas chromatograph. This method of infrared sampling produces condensed phase spectra which have bands widths that are somewhat intermediate to room temperature and matrix-isolated spectra. This permits searching of existing large condensed phase libraries for identification purposes. The qualitative capabilities of this instrument are particularly beneficial where isomer specific identifications are necessary. In the case of the polychlorinated biphenyl (PCB) congeners little reliable IR spectral data exists for these compounds. Utilizing the instrumentation described above, high quality spectral data has been accumulated for approximately 130 PCB cogeners/isomers. This library has been used very successfully to identify specific PCB cogeners and isomers in commercial Aroclor mixtures. 10 figs., 2 tabs.

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Refer also to citation(s) 17720, 17721, 17737, 17746, 17750, 17752, 17759, 17773, 17775, 17829, 17865, 17866, 17874, 17926, 17951, 17970, 17992, 18018, 18030, 18062, 18398, 18801, 18952, 18957, 18987, 19001, 19040, 19041, 19044, 19045, 19056, 19062, 20286

19014 (BNL–46985) **Direct studies of the thermal decomposition of N_2O and CO_2 and of the reaction of CO with O_2.** Sutherland, J.W.; Patterson, P.M.; Klemm, R.B. Brookhaven National Lab., Upton, NY (United States). [1992]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920707–17: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92007183. Source: OSTI; NTIS; GPO Dep.

The thermal decompositions of N_2O and CO_2 was investigated by monitoring the kinetics of formation of $O(^3P)$ atoms in the reflected shock regime using atomic resonance absorption spectrophotometry (A.R.A.S.). The temperature range was 1805K to 2379K for N_2O and 2332K to 2869K for CO_2. Total densities were 3–4 x 10^{18} molecules cm^{-3} and hence the reported rate constants are at or near the low pressure limit for unimolecular decomposition. The results were expressed by the following Arrhenius equations: CO_2 $k(T) = (1.63 \pm 1.96) \times 10^{-8} \exp(-122565 \pm 5183/RT)$ cm^3 $molecule^{-1}$ s^{-1} N_2O $k(T) = (6.02 \pm 2.81) \times 10^{10} \exp(-53397 \pm 1865/RT)$ cm^3 $molecule^{-1}$ s^{-1}. Uncertainties in the Arrhenius expressions are given at the one standard deviation level and the mean deviations of the experimental data from the respective expression are ± 18.6% and ± 30.7%. Corresponding values for the reverse reaction, $k_{rev}(CO_2)$ were computed from the expression $k_{for}/k_{rev} = K_c$. The value obtained for $k_{rev}(CO_2)$ was $(2.18 \pm 0.83) \times 10^{-34}$ cm^6 $molecule^{-2}$ s^{-1}, independent of temperature from 2332K to 2869K. Preliminary results are also reported for the direct determination of the rate constant for the reaction, $CO + O_2 \rightarrow CO_2 + O$, from measurements of the initial rate of formation of $O(^3P)$ atoms. 35 refs., 9 figs., 4 tabs.

19015 (CDM–27) **Differential pulse polarographic determination of molybdenum (VI) in phosphoric medium by benzoin alpha oxime.** Chergouche, S. (Centre de Developpement des Materiaux, Algiers (Algeria). Lab. d'Analyse); Achache, M. Centre de Developpement des Materiaux, Algiers (Algeria). Lab. d'Analyse. Feb 1992. 17p. (MDRTE-CDM–27.). Order Number DE92625329. Source: OSTI; NTIS (US Sales Only); INIS.

The extraction of Molybdenum (VI) using both 4-Methylpentane-2-one (hexone) and chloroform dissolved Benzoin-alpha-oxime has been investigated in order to develop a simple and sensitive polarographic method allowing the analysis of Molybdenum (VI) contained in industrial phosphoric acid produced in ANNABA (Eastern Algeria). The investigation takes into account various parameters such as: The stirring time, solvent rate, the number of stages ... as well as the organic phase conditioning during the polarographic analysis.

19016 (CONF-920761–4) **Experimental studies of aluminum solubility and speciation in brines.** Wesolowski, D.J.; Palmer, D.A. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92010448. Source: OSTI; NTIS; GPO Dep.

The solubility of gibbsite – $Al(OH)_3$ – has been measured in (a) Na^+-H^+-Al^{3+}-Cl^- brines to 70°C and 5 molal ionic strength; (b) $Na^+K^{+-}OH^-$-Cl^--$Al(OH)_4{}^-$ brines to 80°C and 5 molal; and (c) at 50°C in 0.1 molal NaCl with the H^+ concentration controlled by acetate, bis-tris and tris buffers at $-\log[H^+]$ – 3 to 9. The activity coefficient ratios, $(\gamma Al^{3+})/(\gamma H^+)^3$ and $(\gamma Al(OH)_4{}^-)/(\gamma OH^-)$, have been modeled in the 0–100°C range using the Pitzer ion interaction treatment. Complexes of Al^{3+} with acetate and $Al(OH)_4{}^-$ with bis-tris have been identified. Our results indicate that complexation of Al^{3+} by chloride is insignificant in this temperature range. The formation constants of $Al(OH)^{2+}$ have been quantitatively determined by potentiometric titrations in the range 25–125°C and 0–5 molal ionic strength in NaCl media. After correcting for complexation of aluminum ions with the buffers, our solubility data at near neutral pH's are shown to be in quantitative agreement with the potentiometric results.

19017 (CONF-920761–5) **Acetate in hydrothermal solutions: Decomposition kinetics and metal complexation.** Bell, J.L.S. (Oak Ridge National Lab., TN (United States)); Palmer, D.A.; Barnes, H.L. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92010542. Source: OSTI; NTIS; GPO Dep.

Hydrothermal kinetics experiments indicate that acetate decomposes under achievable hydrothermal conditions dependant upon solution pH and the catalytic and/or oxidizing ability of mineral surfaces present. Surfaces studied thus far include quartz, calcite, pyrite, Ca-montmorillonite, iron-bearing montmorillonite, magnetite, and hematite. Acetate decompositon in hydrothermal brines is expected to affect the ligand concentration, pCO_2, and pH buffering capacity of the brine; thus, the kinetics of acetate decomposition have important implications for metal carboxylate speciation. Potentiometric titrations were used to measure formation constants of acetate complexes with aluminum in NaCl brine to 5 mol/kg and at temperatures to 125°C.

19018 (CONF-920761–7) **Excess molar volumes for CO_2-CH_4-N_2 mixtures.** Seitz, J.C. (Oak Ridge National Lab., TN (United States)); Blencoe, J.G.; Joyce, D.B.; Bodnar, R.J. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant: EAR-8857778-03PYI. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92010886. Source: OSTI; NTIS; GPO Dep.

Vibrating-tube densimetry experiments are being performed to determine the excess molar volumes of single-phase CO_2-CH_4-N_2 gas mixtures at pressures as high as 3500 bars and temperatures up to 500°C. In our initial experiments, we determined the P-V-T properties of: (1) CO_2-CH_4, CO_2N_2, CH_4-N_2, and CO_2-CH_4-N_2 mixtures at 1000 bars. 50 °C: and (2) CO_2-CH_4 mixtures from 100 to 1000 bars at 100°C. Excess molar volumes in the binary subsystems are very accurately represented by two-parameter Margules equations. Experimentally determined excess molar volumes are in fair to poor agreement with predictions from published equations of state. Geometric projection techniques based on binary system data yield from published equations of state. Geometric projection techniques based on binary system data yield calculated excess molar volume for CO_2-CH_4-N_2 mixtures that are in good agreement with our experimental data. 7 refs., 8 figs.

19019 (DOE/ER/13263–8) **Oligomer and mixed-metal compounds potential multielectron transfer catalysts: Progress report, January 1, 1991–January 1, 1992.** Rillema, D.P. North Carolina Univ., Charlotte, NC (United States). Dept. of Chemistry. 30 Mar 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER13263. Order Number DE92011347. Source: OSTI; NTIS; GPO Dep.

Projects related to the design and characterization of multimetallic complexes has proceeded forward with a number of achievements. First, photoprocesses in hydrogel matrices lead to the conclusion that cationic metallochromophores could be ion exchanged into a hydrogel matrix (κ-carageenan) and substantial photocurrents could be generated. Second, X-ray structures of $Ru(bpy)_3{}^{2+}$, $Ru(bpm)_3{}^{2+}$ and $Ru(bpz)_3{}^{2+}$, where bpy is 2,2′-bipyridine, bpm is 2,2′-bipyrimidine and bpz is 2,2′-bipyrizine, were obtained and revealed similar Ru-N bond distances in each complex even though their σ-donor and π-acceptor character differ markedly. The structure parameters are expected to provide theoreticians with the information needed to probe the electronic character of the molecular systems and provide us with direction in our synthetic strategies. Third, a copper(I) complex was synthesized with a dimeric-ethane-bridged, 1,10-phenanthroline ligand that resulted in isolation of a bimetallic species. The copper(I) complex did luminesce weakly, suggesting that the dimer possesses potential electron transfer capability. Fourth, the photophysical properties of $[Re(CO)_4(L\text{-}L)]^+$, where L-L = heterocyclic diimine ligands, and $Pt(bph)X_2$, where bph = the dianion of biphenyl and X = CH_3CN, py or ethylendiamine, displayed luminescence at high energy and underwent excited-state electron transfer. Such high energy emitters provide high driving forces for undergoing excited-state electron transfer. Fifth, both energy and electron transfer were observed in mixed-metal complexes bridged by 1,2-bis(2,2′-bipyridyl-4′-yl) ethane.

19020 (DOE/ER/13469–T2) **Research in chemical kinetics: Progress report, January 1, 1991–December 31, 1991.** Rowland, F.S. California Univ., Irvine, CA (United States). Dept. of Chemistry. [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER13469. Order Number DE92013503. Source: OSTI; NTIS; GPO Dep.

This report contains sections on the reaction of chlorine atoms with 1,1,1,2-terafluoroethane, abstraction reactions by thermal chlorine atoms with hfc-134a, and chlorine atom reactions with vinyl bromide.

19021 (DOE/ER/13657–T1) **Experimental and computer modeling studies of isotopically selective two-step laser photodissociation of small molecules: Final report.** Zittel, P.F. Aerospace Corp., El Segundo, CA (United States). Engineering and Technology Group. 25 Mar 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13657. Order Number DE92011427. Source: OSTI; NTIS; GPO Dep.

The approach to laser isotope separation taken in this study is based on isotopically selective, two-step, laser photodissociation of small molecules. A primary goal of this study is the measurement of fundamental molecular processes which control the two-step, photodissociative isotope enrichment process. This objective has led to experimental measurements of uv photodissociation cross sections for vibrationally excited states of several small molecules, including the first cross section reported for any neutral molecule in a specific, excited vibrational state. A second goal of this study has been the laboratory demonstration of isotope enrichment for isotopes of practical interest and for processes with a potential for larger scale production. Where possible, efforts have focussed on the separation of middle isotopes, such as ^{17}O and ^{33}S, which are expensive and difficult to separate using other techniques. Considerable success has been achieved in demonstrating the enrichment of isotopes of bromine, carbon, oxygen and a third goal of this study has been the application of computer modeling to the two-step enrichment process. Experimental measurements define as many as possible of the critical photophysical and chemical parameters required by an ab initio computer model of the enrichment process. Progress toward these goals has been documented in detail in a variety of journal articles and technical reports. It is not the objective of this final report to discuss each aspect of the work done under this contract/grant in detail. A general overview of the program, touches briefly on each of the problems addressed by the study and provides references to more detailed discussions. 19 refs.

19022 (DOE/ER/13775–3) **[Comparison of group transfer, inner sphere and outer sphere electron transfer mechanisms of organometallic complexes: Progress report].** Atwood, J. State Univ. of New York, Buffalo, NY (United States). Research Foundation. [1990]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13775. Order Number DE92012539. Source: OSTI; NTIS; GPO Dep.

We have constructed an infrared stopped-flow spectrophotometer and initiated a study of the mechanisms of reactions that involve a change in the oxidation state of organometallic complexes. In this summary we highlight our results on reactions (1) that formally involve exchange of a charged species between two metal carbonyl anions, (2) that involve addition of an electron to, or removal of an electron from organometallic complexes that contain a metal-metal bond, and (3) between coordination complexes and metal carbonyl anions.

19023 (DOE/ER/13775–T1) **[Mechanistic examination of organometallic electron transfer reactions: Annual report, 1989].** State Univ. of New York, Buffalo, NY (United States). Research Foundation. [1989]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13775. Order Number DE92012538. Source: OSTI; NTIS; GPO Dep.

Our mechanistic examination of electron transfer reactions between organometallic complexes has required data from our stopped-flow infrared spectrophotometer that was constructed in the first year. Our research on organometallic electron transfer reaction mechanisms was recognized by an invitation to the Symposium on Organometallic Reaction Mechanisms at the National ACS meeting in Miami. We have obtained a reasonable understanding of the electron transfer reactions between metal cations and anions and between metal carbonyl anions and metal carbonyl dimers. In addition we have begun to obtain data on the outer sphere electron transfer between metal carbonyl anions and coordination complexes and on reactions involving cluster anions.

19024 (DOE/ER/13842–T2) **Cyclometallated and cyclometalsilylated complexes of transition elements as photoredox sensitizers: Progress report, October 1, 1991–November 31, 1992.** Watts, R.J. California Univ., Santa Barbara, CA (United States). Dept. of Chemistry. [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER13842. Order Number DE92012228. Source: OSTI; NTIS; GPO Dep.

An account of a vastly improved synthesis of tris-ortho-metalated Ir(III) complexes of 2-phenylpyridine and related ligands has been published. The emission energies, excited state lifetimes and ground state oxidation potentials of these species have also been reported, and from these data potentials for the excited states to function as reducing agents can be estimated. These estimates as well as a summary of several potential means for using these and related photocatalysts to carry out demanding chemical reductions and oxidations have also been published. Several projects within this area are being actively researched at this time, including the following: (a) production of strong reducing agents by photoreduction of tris-ortho-metalated species; (b) precursors for generation of solvated monomeric photocatalysts, and; (c) photochemical methanol production from CO_2 and H_2O.

19025 (DOE/ER/45125–9) **Structure and shear response of lipid monolayers: Progress report, August 1, 1990–July 31, 1991.** Dutta, P.; Ketterson, J.B. Northwestern Univ., Evanston, IL (United States). Feb 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER45125. Order Number DE92011633. Source: OSTI; NTIS; GPO Dep.

We have been studying lipid monolayers both on the surface of water and after transfer to solid substrates. On the surface of water, we have determined in detail the structure of heneicosanoic acid monolayers along a high-pressure isobar, and correlated this information with viscosity data. We have also determined the effect of ions in the subphase on acid monolayer structure (as a function of pH). We have studied capillary waves on monolayer-covered water surfaces, and we find that these monolayers can be quite anisotropic in some phases, so that the monolayer 'pressure' is to always a meaningful quantity. Using atomic force microscopy, we have seen 'islands' in Langmuir-Blodgett monolayers without the need for a dye, plus features that are to visible using fluorescence microscopy.

19026 (INEL/MISC--92032) **DOE solvent handbook information sheet.** Chavez, A.A. Idaho National Engineering Lab., Idaho Falls, ID (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012218. Source: OSTI; NTIS; INIS; GPO Dep.

Solvents and cleaners are used in the Department of Defense (DOD) and the Department of Energy-Defense Program (DOE-DP) maintenance facilities for removing wax, grease, oil, carbon, machining fluids, solder fluxes, mold releases, and other contaminants before repairing or electroplating parts. Private industry also uses cleaners and degreasers for surface preparation of various metals. Growing environmental and worker safety concerns have brought attention to these solvents and cleaners, most of which are classified as toxic. Tightening government regulations have already excluded the use of some chemicals, and restrict the use of various halogenated hydrocarbons because of their atmospheric-ozone depleting effects, as well as their cancer-related risks. As a result, a program was established to develop an efficient, easily accessible, electronic solvent utilization handbook. This is being accomplished by: (1) identifying solvents (alternatives) that are not currently restricted by government regulations for use DOE-DP facilities, and private industry, (2) evaluating their cleaning performance, (3) evaluating their corrosivity, (4) evaluating their air emissions, (5) evaluating the possibility of recycling or recovering all or portions of the alternative degreasers, (6) testing substitute solvents compatibility with non-metallic materials, (7) inputting all of the data gathered (including previous biodegradability information) into a database, and (8) developing a methodology for efficient, widespread access to the data base information system.

19027 (INIS-SU--305/A, pp. 219) **Coextraction of nitrosoruthenium nitrates with uranium (6) in TBP - HNO_3 - $UO_2(NO_3)_2$ system.** Obruchnikov, A.V. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Ochkin, A.V.; Smelov, V.S.; Chubukov, V.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. RUTHENIUM COMPLEXES/solvent extraction; URANYL COMPLEXES/solvent extraction; CHEMICAL REACTION KINETICS; DISTRIBUTION FUNCTIONS; NITRIC ACID; NITRIC OXIDE; QUANTITY RATIO; SOLVATION; TBP; URANYL NITRATES

19028 (INIS-SU--305/A, pp. 222) **Adducts of monosubstituted polyethylene glycols (PEG) with complex inorganic acids (CIA) as extractants for cesium and strontium.** Smirnov, I.V. (Radievyj Inst., Leningrad (USSR)). AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CESIUM COMPLEXES/solvent extraction; STRONTIUM COMPLEXES/solvent extraction; ADDUCTS; ANTIMONY COMPOUNDS; CHEMICAL COMPOSITION; CHEMICAL REACTION KINETICS; CHLORINE COMPOUNDS; MOLYBDOPHOSPHORIC ACID; PH VALUE; POLYETHYLENE GLYCOLS; SILICON COMPOUNDS

19029 (INIS-SU--305/A, pp. 265) **Description of lanthanide extraction with tributyl phosphate from nitrate media in the presence of phosphoric acid.** Kopyrin, A.A. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Burtsev, I.A.; Sedov, M.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NEODYMIUM COMPLEXES/solvent extraction; SOLVENT EXTRACTION/mathematical models; CHEMICAL REACTION KINETICS; COMPUTERIZED SIMULATION; DISTRIBUTION FUNCTIONS; NEODYMIUM NITRATES; NITRIC ACID; PHOSPHORIC ACID; SOLVATION; TBP

19030 (INIS-SU--305/A, pp. 267) **Optimization of yttrium and scandium separation using regression analysis method.** Petrova, E.N. (Permskij Gosudarstvennyj Univ., Perm (USSR)); Degtev, M.I. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. SCANDIUM COMPLEXES/solvent extraction; SOLVENT EXTRACTION/optimization; YTTRIUM COMPLEXES/solvent extraction; MATHEMATICAL MODELS; ORGANIC CHLORINE COMPOUNDS; PH VALUE; PYRAZOLINES; REGRESSION ANALYSIS; OPTIMIZATION

19031 (INIS-SU--305/A, pp. 268) **Mathematical simulation of yttrium and lanthanide extraction with tri-n-butyl phosphate in the presence of ammonium nitrate in the presence of ammonium nitrate and ethylenediaminetetraacetic acid.** Pyartman, A.K. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Kopyrin, A.A.; Keskinov, V.A.; Solodukhin, S.S.; Puzikov, E.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. RARE EARTH COMPLEXES/solvent extraction; SOLVENT EXTRACTION/mathematical models; YTTRIUM COMPLEXES/solvent extraction; AMMONIUM NITRATES; DISTRIBUTION FUNCTIONS; EDTA; TBP

19032 (INIS-SU--305/A, pp. 271) **Mathematical simulation of rare earth metal separation processes in multistage extraction apparatus.** Solodukhin, S.S. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Pyartman, A.K.; Segeda, Yu.G.; Keskinov, V.A.; Kopyrin, A.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310--: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. RARE EARTH COMPLEXES/solvent extraction; SOLVENT EXTRACTION/computerized simulation; YTTRIUM COMPLEXES/solvent extraction; DAMPA; MIXER-SETTLERS; NITRIC ACID; TBP

19033 (INIS-SU--305/A, pp. 273) **Multistage extraction separation of elements in spiral columns.** Zolotov, Yu.A. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii); Spivakov, B.Ya.; Maryutina, T.A.; Bashlov, V.L. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow

(USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CADMIUM COMPOUNDS/extraction chromatography; CESIUM COMPOUNDS/extraction chromatography; HAFNIUM COMPOUNDS/extraction chromatography; RARE EARTH COMPOUNDS/extraction chromatography; STRONTIUM COMPOUNDS/extraction chromatography; ZIRCONIUM COMPOUNDS/extraction chromatography; EXTRACTION COLUMNS; LEACHING; LIQUID COLUMN CHROMATOGRAPHY; REAGENTS; ZINC COMPOUNDS

19034 (INIS-SU–305/A, pp. 295) **Extraction of rhodanide complexes of elements with cyanine dyes from aqueous-organic media.** Kish, P.P. (Uzhgorodskij Gosudarstvennyj Univ., Uzhgorod (Ukraine)); Bazel', Ya.R.; Studenyak, Ya.I.; Kormosh, Zh.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. INDIUM/quantitative chemical analysis; INDIUM COMPLEXES/photometry; INDIUM COMPLEXES/solvent extraction; AMIDES; CHEMICAL COMPOSITION; CYANINE DYES; INDIUM; PHOTOMETRY; ORGANIC SOLVENTS; THIOCYANATES

19035 (LA-UR–92-40) **Catalysis at experimentally designed surfaces: n-Butane hydrogenolysis at Sn/Group VIII surface alloys.** Logan, A.D.; Paffett, M.T. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920701–1: 10. international congress on catalysis, Budapest (Hungary), 19-24 Jul 1992). Order Number DE92007424. Source: OSTI; NTIS; GPO Dep.

Bimetallic $\sqrt{3}$x$\sqrt{3}$R30°-Sn/M(111) [M=Ni, Pt] surface alloys have been prepared in an ultrahigh vacuum system and used in model moderate pressure (1–200 Torr) catalytic reactions. Hydrogenolysis of n-butane (H_2/n-C4=20) has been used to characterize the effects of ordered bimetallic ensembles relative to those available at the respective (111) surfaces. The effect of alloying Sn into the Ni(111) surface produced an overall lowering of the catalytic reactivity nearly equal to the number of Ni surface sites lost upon producing the $\sqrt{3}$x$\sqrt{3}$R30° surface alloy. In addition, the overall rate of hydrogenolysis of n-butane at the $\sqrt{3}$x$\sqrt{}$R30°-Sn/Pt(111) surface alloy was also found to have decreased (although not in proportion to the loss of total Pt atoms). Catalytic deactivation due to carbon buildup was observed to decrease significantly at both of the ordered $\sqrt{3}$x$\sqrt{3}$R30°-Sn/M(111) surface alloys under reaction conditions.

19036 (LBL–31194) **Thermodynamics of aqueous sodium sulfate from the temperatures 273 K to 373 K and mixtures of aqueous sodium sulfate and sulfuric acid at 298.15 K.** Hovey, J.K. (Lawrence Berkeley Lab., CA (United States)); Pitzer, K.S.; Rard, J.A. Lawrence Berkeley Lab., CA (United States). Jul 1991. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9107180–2: 47. annual calorimetry conference, DeKalb, IL (United States), 1 Jul - 1 aug 1991). Order Number DE92011729. Source: OSTI; NTIS; GPO Dep.

New isopiestic vapor-pressure measurements on the aqueous system $\{(1-y)H_2SO_4+yNA_2SO_4\}$ along with earlier experimental investigations that span the range from y=0 to y=1 and infinitely dilute to supersaturated molalities have been analyzed in terms of the Pitzer ion-interaction model. Refined ion-interaction parameters for aqueous sodium sulfate valid over the temperature range 273 K to 373 K have been calculated and used for analyzing results for mixtures containing sulfuric acid and sodium sulfate at 298.15 K. Analysis of experimental results for these aqueous mixtures required explicit consideration of the dissociation reaction of bisulfate ion. Previous treatments of aqueous sulfuric acid and subsequently the bisulfate dissociation equilibrium valid in the range 273 K to 343 K were employed as a first approximation in representing the mixed solutions. Two sets of Pitzer ion-interaction parameters are presented for (sodium sulfate + sulfuric acid). The validity of the first set is limited in ionic strength and molality to saturated solutions of pure aqueous sodium sulfate (4 $\mathrm{mol{\cdot}kg^{-1}}$). The second set of parameters corresponds to a slightly less precise representation but is valid over the entire range of experimental results considered. Both sets of parameters provide a more complete description of pure sulfuric acid solutions because of the removal of various redundancies of ion-interaction parameters. The specific ion-interaction terms used and the overall fitting procedure are described as well as selected examples of relevant thermodynamic calculations in the mixed system Na_2SO_4-H_2SO_4-H_2O. 33 refs., 6 figs., 5 tabs.

19037 (NEI-DK–807) **Kinetics and mechanism for the SO_2-oxidation with $V_2O_5/K_2S_2O_7$-catalysts.** Nielsen, P.E. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. Jun 1990 303p. Order Number DE92506345. Source: OSTI; NTIS (US Sales Only).

The thesis deals with measurements of the sulphur dioxide oxidation reaction rate with $V_2O_5/K_2S_2O_7$-catalysts. The catalysts are in the liquid phase at the conditons of the reaction; bacause of this the catalysts are deposited on a support (Controlled Pore Glass). The dependence of the reaction rate on the partial pressures of O_2, SO_2 and SO_3 has been examined. The reaction is performed in a four-stage reactor systems with intermediate cooling and absorption of SO_3 after the third and fourth stage. A catalyst enabling a design without expensive absorption is of great interest. A survey of relevant literature is given. The potential use of salt melts is described. Advantages and disadvantages of different reactor designs and analysis methods are explained. Reaction rate expressions are tried. It is shown that different kinetic behaviours in the low-temperature region can be accounted for by crystallization of different vanadium complexes. The measurements show the expected sharp break in the Arrhenius plots with a low apparent activation energy in the high-temperature region and high apparent activation energy in the low-temperature region. No drastic changes in the break point temperature are seen between K/V = 3.5 and 10.0. The reaction rate is close to first order in dependence of the partial pressure of O_2 for both K/V-ratios 3.5 and 10.0. The dependence on SO_2 seems not to depend on the K/V-ration, whereas the dependence on SO_3 seems to depend on the K/V-ratio. Results of the measurements are given. (AB) 57 refs.

19038 (SAND–91-8706) **Hydrogenation reactions of neutral carbon clusters: C_n (n = 6-75) + D_2.** Butenhoff, T.J.; Rohlfing, E.A. Sandia National Labs., Livermore, CA (United States). [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–2: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92005330. Source: OSTI; NTIS; GPO Dep.

The hydrogenation reactions of neutral carbon clusters, $C_n + D_2$, are examined over a wide range of cluster sizes, n=6-75. Clusters are created by pulsed laser vaporization of graphite and react with D_2 in a pulsed, fast-flow reactor. After supersonic expansion and collimation the cluster reactants and products are photoionized at 118.2 nm and mass analyzed via high-resolution time-of-flight mass spectrometry. We report reaction propensities that include relative rate as a function of cluster size, the identification of favored reaction products, and the implications of product appearance rates on possible reaction mechanisms. These propensities show strong evidence for the onset of the closed-shell fullerene structures for C_{2n} beginning at n=18. 5 figs., 15 refs.

19039 (SKB-TR–91-47) **On the interaction of granite with Tc(IV) and Tc(VII) in aqueous solution.** Eriksen, T.E. (Royal Inst. of Tech., Stockholm (Sweden)); Cui, Daquing. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Oct 1991. 45p. Order Number DE92627706. Source: OSTI; NTIS (US Sales Only); INIS.

The behaviour of technetium in granite-groundwater systems under reducing conditions was investigated. The anion TcO_4^- was reduced to Tc(IV) and simultaneously precipitated as TcO_2xnH_2O on the granite surfaces. The electron sources are assumed to be iron oxides and/or iron containing minerals in the granite. The technetium concentration in ground water under repository conditions may be predicted assuming TcO_2xnH_2O as the solid phase and $TcO(OH)_2{}^0$ and $TcO_4{}^-$ as the predominant aqueous complexes using a formation constant for $TcO(OH)_2{}^0$ of log K = -8.16 and a standard reduction potential E^0 for the reaction $TcO_4{}^- + 3e^- + 4H^+ = TcO_2xnH_2O$ of 0.738 V. The surface related distribution ratio K_a for $TcO(OH)_2{}^0$ between Stripa granite and ground water is approximately 1 cm based on geometrical surface area. (au).

4004 Electrochemistry

Refer also to citation(s) 17768, 18233, 18895

19040 (SAND–92-0193C) **[Numerical simulation of the dynamic behavior of the polymeric gels].** Segalman, D. (Sandia National Labs., Albuquerque, NM (United States)); Witkowski, W.; Adolf, D.; Shahinpoor, M. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9203127–1: 1. international conference on intelligent materials, Oiso-Machi (Japan), 23-25 Mar 1992). Order Number DE92011358. Source: OSTI; NTIS; GPO Dep.

Theoretical models have been formulated describing the dynamic behavior of the swelling and contracting of polyelectrolyte gels. This paper presents a method of weighted residuals approach to solving the governing system of equations by finite element analysis. The modulation of the imbibition of solvent by a spherical gel is studied.

4005 Photochemistry

Refer also to citation(s) 18233, 18973, 18990, 19019, 19024, 19044, 19045, 20284, 20286

19041 (DOE/ER/13633–11) **Excited state processes in transition metal complexes: Redox splitting in soluble polymers: Progress report, November 15, 1991–November 14, 1992.** Meyer, T.J. North Carolina Univ., Chapel Hill, NC (United States). Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER13633. Order Number DE92011808. Source: OSTI; NTIS; GPO Dep.

In our research there were two major themes. The first was the continued development of excited states as sensitizers. In one sequence of experiments the synthetic aspects of this area were developed in further detail both by extending the chemistry of the polypyridyl-accepting ligands associated with the excited state and by developing a new procedure for the preparation of unsymmetrical tris-chelate complexes. The second important aspect of this work was the continued investigation of the molecular and electronic structure characteristics of this class of excited states and how those factors determine such properties as photostability and excited state decay. This effort was extended to complexes of Re(I) and an examination of their excited state characteristics, the role of hydride ligand in determining the properties of excited states, the calculation of relative nonradiative decay rate constants for a series of complexes of Ru(II), the participation of higher lying excited states in decay in complexes of Ru(II) and Os(II), and the application of the transient infrared technique to the elucidation of a photochemical intermediate following laser flash excitation. The second area of study involved excited states in soluble polymers to investigate photoinduced electron and energy transfer in multicomponent assemblies. This work was based on chemically derivatized polystyrene polymers which contain combinations of chromophores and electron or energy transfer quenchers.

19042 (ENEA-RT-INN–90-24) **Optical detection of benzene fragmentation in I.R. and vis.-u.v. laser induced processes.** Engeln, R.; Fantoni, R. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione; Nijmegen Univ. (Netherlands). May 1991. 13p. (RT/INN–90-24). Order Number DE92506291. Source: OSTI; NTIS (US Sales Only); INIS.

A- broad-band CARS set up has been employed to investigate on-line benzene fragmentation due to multiple-photon processes induced by different laser radiation in IR (CO_2 laser), in the visible (2nd harmonic Nd:YAG laser) and in the u.v. (N_2 laser). Collisional induced formation of C_2 has been demonstrated also in the absence of optical break-down.

4006 Radiation Chemistry

Refer also to citation(s) 18817, 18969, 19827, 19848

19043 (AERE-R–8176(rev.1)) **The radiolytic formation of nitric acid in argon/air/water systems.** May, R.; Stinchcombe, D.; White, H.P. AEA Reactor Services, Harwell (United Kingdom). Jan 1992. 25p. Order Number DE92627736. Source: OSTI; NTIS (US Sales Only); INIS.

The extent of nitric acid formation in the γ-radiolysis of argon/air/water mixtures has been assessed. The yields of nitric acid are found to increase as water vapour pressure is increased but are lower in the presence of a discrete water phase. G values for the formation of nitric acid from argon/air mixtures based on energy absorbed in the air are increased in the presence of argon but the yields in an atmosphere of argon containing small amounts of moist air are smaller than from an atmosphere of moist air alone. The G value for nitric acid formation from pure air in the presence of a distinct water phase is 2, based on energy absorbed in the air. (author).

19044 (DOE/ER/00038–3487) **[Multiprogram Radiation Laboratory primarily involved in radiation chemistry studies]: Quarterly report, January 1, 1992–March 31, 1992.** Notre Dame Univ., IN (United States). Radiation Lab. 7 Apr 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76ER00038. (NDRL–3487;Q–139). Order Number DE92011830. Source: OSTI; NTIS; GPO Dep.

Research projects carried out at the Notre Dame Radiation Laboratory are briefly described. Topics include chemistry of phenols and thiophenols, fullerenes, substituted carbenes, heavy ion track structure, hazardous chemical destruction, and pulsed radiolysis.

19045 (DOE/ER/13852–192) **Studies of radiation-produced radicals and radical ions: Progress report, September 1, 1990–October 15, 1991.** Williams, T.F. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry. [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13852. Order Number DE92011807. Source: OSTI; NTIS; INIS; GPO Dep.

The radiolytic oxidation of anti-5-methylbicyclo[2.1.0]pentane gives the 1-methylcyclopentene radical cation as the sole rearrangement product H migration whereas oxidation of its syn isomer results in the highly selective formation of the 3-methylcyclopentene radical cation by methyl group migration. Since exactly the same stereoselectivity of olefin formation was observed in corresponding PET (photosensitized electron transfer) studies in the liquid phase, it is concluded that the rearrangement in this case also occurs through the intermediacy of radical cations. Clearly, the radical cation rearrangement must occur very rapidly (10^{-8}–10^{-9}s) under liquid-phase conditions at room temperature to compete with back electron transfer, and therefore the hydrogen (or methyl) migration is a fast process under these conditions. An intramolecular cycloaddition reaction was demonstrated in the radical cation rearrangement of 4-vinylcyclohexene to bicyclo[3.2.1]oct-2-ene. ESR studies show that the radiolytic oxidation of quadricyclane in Freon matrices under conditions of high substrate dilution leads to the bicyclo[3.2.0]hepta-2,6-diene radical cation as well as the previously reported norbornadiene radical cation, the former species predominating at sufficiently low concentrations.

19046 (INIS-SU–305/A, pp. 217) **Features of extraction of radiolysis organic products in extractants - diluent - radiolysis products - alkaline solution systems.** Markov, G.S. (Radievyj Inst., Leningrad (USSR)); Kokina, S.A.; Moshkov, M.M.; Polyakov, M.S.; Shil'nikov, A.Yu.; Shcherbakov, V.A. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN

SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. DBP/solvent extraction; DODECANE/radiolysis; TBP/radiolysis; AQUEOUS SOLUTIONS; CHEMICAL REACTION KINETICS; DBP; DODECANE; RADIOLYSIS; EMULSIONS; EQUILIBRIUM; ORGANIC SOLVENTS; QUANTITY RATIO; REAGENTS; SODIUM HYDROXIDES; SURFACTANTS; TBP

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 17892, 17901, 17904, 18987, 19027, 19445, 19823, 20288

19047 (AECL–10524) **The effects of residual tritium on air-detritiation dryer performance.** Allsop, P.J.; Senohrabek, J.A.; Miller, J.M.; Romaniszyn, E.F. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.; Ontario Hydro, Toronto, ON (Canada). Nov 1991. 13p. (CONF-910920–: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 29 Sep - 4 oct 1991; COG–91-283.). Order Number DE92627040. Source: OSTI; NTIS (US Sales Only); INIS.

The effects on the performance of an air-detritiation dryer (ADD) of inlet-gas humidity and residual tritiated water (HTO) left on the desiccant following regeneration were demonstrated. Residual HTO significantly reduced the detritiation factor (DF_{SP}) of an ADD from clean-bed values. In addition, HTO/H_2O separation occurred in the ADD, with H_2O leading HTO. HTO roll-up may also have occurred. Finally, an increase in the inlet-gas humidity at constant inlet HTO concentration decreased the DF_{SP} while increasing the humidity-reduction factor (HRF_{SP}).

19048 (CONF-920444–22) **The establishment, nurturing, and fruition of a national transplutonium production program.** Bigelow, J.E. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92011665. Source: OSTI; NTIS; INIS; GPO Dep.

The first two slides describe the discovery of ^{252}Cf and the properties that make it useful as a neutron source. The next two describe the applications. The next two cover the history of the Market Development Program, which is pretty much phased out now, with most residual responsibilities transferred to Oak Ridge. The final slide illustrates the uses of ^{252}Cf that has been sold and commercially fabricated into neutron sources.

19049 (INIS-BR–2922, pp. 137-138) **Radiopharmaceuticals: kits production for use in vitro - quality control.** Rockmann, T.M.B. (Sao Paulo Univ., SP (Brazil). Centro de Medicina Nuclear). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RADIOPHARMACEUTICALS/isotope production; RADIOPHARMACEUTICALS/quality control; NUCLEAR MEDICINE; RADIOPHARMACEUTICALS; SCINTISCANNING

19050 (INIS-mf–13183, pp. 44) **Possibilities for the production of ^{127}Xe at the NAC.** Nortier, F.M. (National Accelerator Centre, Faure (South Africa)); Haasbroek, F.J.; Mills, S.J.; Steyn, G.F. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (In Afrikaans). (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. XENON 127/isotope production; KRYPTON 81; NAC CYCLOTRON; RADIOISOTOPE GENERATORS; RUBIDIUM 81; SOUTH AFRICA; XENON 133

19051 (INIS-SU–305/A, pp. 216) **Behaviour of uranium, neptunium and plutonium during extraction from acid solutions containing $K_{10}P_2W_{17}O_{61}$.** Malikov, D.A. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii); Kuzovkina, E.V.; Milyukova, M.S.; Myasoedov, B.F. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NEPTUNIUM COMPLEXES/solvent extraction; PLUTONIUM COMPLEXES/solvent extraction; URANIUM COMPLEXES/solvent extraction; AMINES; AQUEOUS SOLUTIONS; CHEMICAL COMPOSITION; CHEMICAL REACTION KINETICS; DISTRIBUTION FUNCTIONS; NITRIC ACID; POTASSIUM COMPOUNDS; SULFURIC ACID; TRANSPLUTONIUM COMPOUNDS; TUNGSTOPHOSPHATES; VALENCE

19052 (INIS-SU–305/A, pp. 218) **Extraction of trivalent transplutonium elements with high-molecular amines from acid solutions.** Milyukova, M.S. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii); Kuzovkina, E.V.; Malikov, D.A.; Myasoedov, B.F. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. TRANSPLUTONIUM COMPOUNDS/solvent extraction; AMINES; CHEMICAL COMPOSITION; DISTRIBUTION FUNCTIONS; GERMANIUM COMPOUNDS; HYDROCHLORIC ACID; PH VALUE; QUANTITY RATIO; SILICON COMPOUNDS; SULFURIC ACID; TUNGSTOPHOSPHATES; VALENCE

19053 (INIS-SU–305/A, pp. 220) **On effect of carboxylic acid amide structure on extraction of uranyl nitrate and nitric acid.** Rozen, A.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Nikolotova, Z.I.; Kartasheva, N.A.; Andrutskij, L.G.; Pastukhova, I.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NITRIC ACID/solvent extraction; URANYL NITRATES/solvent extraction; AMIDES; CHEMICAL COMPOSITION; CHEMICAL REACTION KINETICS; DODECANE; MOLECULAR STRUCTURE; SOLVATION

19054 (INIS-SU–305/A, pp. 221) **Neptunium (5) extraction with mono- and bidentate neutral organic phosphorus compounds.** Rozen, A.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Nikolotova, Z.I.; Kartasheva, N.A.; Tananaev, I.G. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NEPTUNIUM COMPLEXES/solvent extraction; CHEMICAL COMPOSITION; CHEMICAL REACTION KINETICS; MOLECULAR STRUCTURE; NITRIC ACID; OXIDATION; QUANTITY RATIO; REDUCTION; TBP; TOPO; VALENCE

19055 (INIS-SU–305/A, pp. 226) **Extraction properties of acid zirconium salts of organic phosphorus acids as applied to problem of TPE, REE and ^{90}Sr isolation from liquid high-level radioactive wastes (LHRW).** Shesterikov, V.N. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Smelov, V.S.; Mukhin, I.V.; Galaktionov, S.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. HIGH-LEVEL RADIOACTIVE WASTES/radioactive waste processing; RARE EARTH COMPLEXES/solvent extraction; STRONTIUM COMPLEXES/solvent extraction; TRANSPLUTONIUM COMPOUNDS/solvent extraction; ZIRCONIUM COMPLEXES/reagents; ZIRCONIUM COMPLEXES/stability; CHEMICAL REACTION KINETICS; HDEHP; PHOSPHONATES; REAGENTS; STABILITY

19056 (INIS-SU–305/A, pp. 269) **Mathematical model of cesium, REE and TPE extraction with chlorinated cobalt dicarbollide.** Romanovskij, V.V. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Afonin, M.A.; Sedov, V.M. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CESIUM COMPLEXES/solvent extraction; RARE EARTH COMPLEXES/solvent extraction; SOLVENT EXTRACTION/mathematical models; TRANSPLUTONIUM COMPOUNDS/solvent extraction; CARBORANES; CESIUM NITRATES; COBALT COMPLEXES; DISTRIBUTION FUNCTIONS; NITRIC ACID; OPTIMIZATION; ORGANIC CHLORINE COMPOUNDS; PH VALUE; TRACE AMOUNTS

19057 (INIS-SU–305/A, pp. 223) **Extraction of Np(4) with di-n-butylphosphoric and di-isoamylphosphoric acids from nitric acid aqueous solutions.** Solovkin, A.S. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Lobanov, A.V. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NEPTUNIUM COMPLEXES/solvent extraction; AQUEOUS SOLUTIONS; CHEMICAL REACTION KINETICS; DBP; DISTRIBUTION FUNCTIONS; NITRIC ACID; ORGANIC SOLVENTS; QUANTITY RATIO; TBP

19058 (INIS-SU–305/A, pp. 283) **Effect of halogenoacetate ions on extraction-chromatographic separation of some recoil elements on organic phosphorus extractants.** Baluev, A.V. (Radievyj Inst., Leningrad (USSR)); Krasnikov, L.V.; Maslenitskij, S.N. AN SSSR, Moscow (USSR). Otdelenie Obshchej i Tekhnicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Neorganicheskoj Khimii; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Probleme Analiticheskaya Khimiya. 1991. 452p. (In Russian). (CONF-9105310–: 9. all-union conference on extraction, Adler (USSR), 20-24 May 1991). In *9. All-union conference on extraction: Summaries of reports.* Order Number DE92001348. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. FISSION PRODUCTS/extraction chromatography; URANIUM COMPLEXES/extraction chromatography; LEACHING; NITRATES; ORGANIC FLUORINE COMPOUNDS; ORGANIC HALOGEN COMPOUNDS; ORGANIC PHOSPHORUS COMPOUNDS; ORGANIC POLYMERS

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 17982, 18216, 18234, 18789, 19038

19059 (BNL–46958) **Shock tube kinetic study of the CH_3 + $H_2 \rightleftharpoons H + CH_4$ reaction and the methane dissociation reaction.** Klemm, R.B.; Sutherland, J.W.; Tao, Wen. Brookhaven National Lab., Upton, NY (United States). [1992]. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920707–18: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92007180. Source: OSTI; NTIS; GPO Dep.

In this kinetic study of (1) the reaction of CH_3 radicals with H_2 and (2) the thermal dissociation of methane, primary product H atoms were monitored directly using the sensitive atomic resonance absorption detection technique. The detection limit for the [H] was about 3×10^{10} atoms cm^{-3}. Rate constants for both reactions were obtained under pseudo-first-order conditions. In addition, computer simulations verified that kinetic complications were avoided. For the reaction of CH_3+H_2, experiments were performed using either acetone or ethane to generate CH_3 radicals rapidly by thermal dissociation in argon. Twenty-four experiments were performed over the temperature range 1346K to 1793K and a rate constant expression derived using linear least-squares analysis: $k_{-2}(T) = (6.0 \pm 0.7) \times 10^{-12} \exp(-5920 \pm 190 K/T)$ cm^3 $molecule^{-1}$ s^{-1}. 46 refs., 5 figs., 5 tabs.

19060 (CONF-920707–21) **Inhibition of moist carbon monoxide oxidation by trace amounts of hydrocarbons.** Yetter, R.A.; Dryer, F.L. Princeton Univ., NJ (United States). Dept. of Mechanical and Aerospace Engineering. [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13503. From 24. international symposium on combustion; Sydney (Australia); 5-10 Jul 1992. Order Number DE92008736. Source: OSTI; NTIS; GPO Dep.

The moist carbon monoxide oxidation reaction perturbed by small quantities of hydrocarbons is studied over the temperature range 1026–1140 K at 1 atm to yield information on the reactions of OH, H, and O radicals with hydrocarbons (RH) and on general mechanistic inhibition behavior. The inhibiting action of hydrocarbons below the second explosion limit of $Co/H_2O/O_2$ mixtures is used for obtaining rate parameters for RH + OH in the case of methane and propene. Considering all the hydrocarbons studied, the general ranking of effectiveness as an inhibitor was found to follow the order: propene > propane > methane > ethane > ethene > acetylene. In fact, acetylene was observed to always promote the oxidation of moist CO, thus emphasizing the importance of O-atom radical attack rather than OH attack on acetylene. The kinetics of these mixtures are shown to complement mechanistic studies on RH/O_2 mixtures for the development and validation of hierarchical hydrocarbon oxidation reaction mechanisms.

19061 (DOE/ER/13812–T1) **A shock tube study of the reactions of the hydroxyl radical with combustion species: Progress report, June 1990–May 1991.** Cohen, N. Aerospace Corp., Los Angeles, CA (United States). Space and Environment Technology Center. 21 May 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13812. Order Number DE92012573. Source: OSTI; NTIS; GPO Dep.

The reactions of OH radicals with hydrocarbons have received a great deal of attention in recent years because of these processes are principal steps in the oxidation of organic fuels – whether occurring in combustion/propulsion systems, in the atmosphere, or elsewhere. Of the various radicals capable of attacking hydrocarbons, OH radicals are generally the most reactive, and their reactions directly yield water molecules, one of the major final oxidation products. In the atmosphere, the combined effect of the OH radical's reactivity and concentration make it the single species that determines the atmospheric lifetime of an organic substance. The principal goals of the kineticist in the field of oxidation chemistry are (1) to measure as many elementary reaction rate coefficients as are conveniently studied in the laboratory; and (2) to develop theoretical and/or semiempirical tools for extrapolating from measured rate coefficients to unmeasured ones. The latter step is necessary because of the sheer number of reactions of possible interest.

19062 (DOE/ER/14189–1) **Theoretical studies of the reactions and spectroscopy of radical species relevant to combustion reactions and diagnostics: Progress report, 1 July 1991–15 March 1992.** Yarkony, D.R. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Chemistry. Apr 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER14189. Order Number DE92013484. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the use of our electronic structure algorithms to treat nonadiabatic processes relevant to combustion diagnostics and combustion reactions during the first nine months of Department of Energy grant DE-FG02-91ER14189 and outlines future work to be performed. During this period problems have been addressed in detail: (1) the possibility of using photoionization spectroscopy to detect CH_3O, (2) the lifetimes of the individual ro-vibronic levels in OH(v=3) a state that has been suggested as a fluorescence probe of OH produced in combustion environments and (3) the basic mechanism for the spin-forbidden initiating step in the Fenimore mechanism for the production of NO in flame fronts, $CH(X^2\Pi) + N_2(X^1\Sigma_g^+) \rightarrow HCN(X^1\Sigma^+) + N(^4S)$.

19063 (DOE/ER/14192–1) **Probing flame chemistry with MBMS, theory, and modeling: Annual progress report, July 15, 1991–July 14, 1992.** Westmoreland, P.R. Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering. Mar 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER14192. Order Number DE92011433. Source: OSTI; NTIS; GPO Dep.

The program objective is to establish kinetics of combustion and molecular weight growth in C_3 hydrocarbon flames as part of an ongoing study of flame chemistry. Specific reactions to be studies are (1) the oxidation reactions of O and OH with C_3's and (2) the growth reactions of C_3H_5 and C_3H_3 with themselves and with unsaturated hydrocarbons. Our approach combines molecular-beam mass spectroscopy (MBMS) experiments which give concentrations of stable species and free radicals in low-pressure flat flames; theoretical predictions of rate constants by thermochemical kinetics, Biomedical Quantum-RRK, RRKM, and master- equation theory; and whole-flame modeling using full mechanisms of elementary reactions. Detailed MBMS flame data are the principal results of the first nine months of the grant. Spatial profiles of temperature, area expansion ratio, and mole fraction have been mapped in two low-pressure flat flames, one fuel-lean ($\phi = 0.229$) and the other fuel-rich ($\phi = 1.64$) in propene/oxygen/argon. Species identities and trends suggest certain chemical pathways, but reaction theory and flame modeling are beginning to provide specific, quantitative insights into oxidation and growth chemistry. 5 refs., 23 figs., 1 tab.

19064 (LBL–31590) **Flame front geometry in premixed turbulent flames.** Shepherd, I.G. (Lawrence Berkeley Lab., CA (United States)); Ashurst, W.T. Lawrence Berkeley Lab., CA (United States). Dec 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ;AC04-76DR00789. (CONF-920707–26: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992; SAND–92-8504C). Order Number DE92010310. Source: OSTI; NTIS; GPO Dep.

Experimental and numerical determinations of flame front curvature and orientation in premixed turbulent flames are presented. The experimental data is obtained from planar, cross sectional images of stagnation point flames at high Damkoehler number. A direct numerical simulation of a constant energy flow is combined with a zero-thickness, constant density flame model to provide the numerical results. The computational domain is a 32^3 cube with periodic boundary conditions. The two-dimensional curvature distributions of the experiments and numerical simulations compare well at similar q'/S_L values with means close to zero and marked negative skewness. At higher turbulence levels the simulations show that the distributions become symmetric about zero. These features are also found in the three dimensional distributions of curvature. The simulations support assumptions which make it possible to determine the mean direction cosines from the experimental data. This leads to a reduction of 12% in the estimated flame surface area density in the middle of the flame brush. 18 refs.

19065 (SAND–91-8712) **Degenerate four-wave mixing using a tunable excimer laser to detect combustion gases.** Meijer, G. (Katholieke Univ. Nijmegen (Netherlands). Atomic and Molecular Physics); Versluis, M.; Chandler, D.W. Sandia National Labs., Livermore, CA (United States). [1991]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–4: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92005327. Source: OSTI; NTIS; INIS; GPO Dep.

A simple degenerate four wave mixing with forward geometry (DFWM-FG) experiment is used to monitor weak absorptions of stable molecules of combustion interest in the gas phase. DFWM-FG with a tunable ArF excimer laser enables us to detect H_2 via the two-photon allowed E,F $^1\Sigma_g \leftarrow X^1\Sigma_g+$ transition, CO via the spin-forbidden $a^3\Pi \leftarrow X^1\Sigma+$ transition and O_2 via the B $^3\Sigma-_u \leftarrow$ X $^3\Sigma-_g$ (Schumann-Runge band) transition. The tunable KrF excimer laser was used to monitor H_2O via the C $^1B_1 \leftarrow$ X $^1A^1$ transition. In all cases the molecules are detected state-selectively. Success of these initial experiments indicates that this technique may have wide application in combustion system.

19066 (SAND–91-8714) **Structure of a methanol/air coaxial reacting spray near the stabilization region by OH fluorescence imaging and two-component phase-Doppler interferometry.** Goix, P.J. (Centre National de la Recherche Scientifique (CNRS), 230 - Mont-Saint-Aignan (France). URA CORIA); Cessou, A.; Stepowski, D.; Edwards, C.F. Sandia National Labs., Livermore, CA (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–1: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92005328. Source: OSTI; NTIS; GPO Dep.

Planar laser-induced fluorescence and two component phase-Doppler interferometry have been used to study the reaction zone structure near the stabilization region of a coaxial methanol/air spray flame. The configuration of the experiment was chosen to simulate the atomizer geometry, surface tension and Weber number of a single coaxial hydrogen/oxygen rocket injector. The measurements are made in a water-cooled, optically-accessible confinement chamber at a pressure of 1 atm. Data are reported for two operating conditions, one yielding a flame length of approximately 1 meter, the other, half that value. Both the Weber number (characterizing the atomization process) and the Reynolds number (characterizing the gas phase mixing process) vary between the two cases, but the data suggest that it is the Weber number which has the dominant effect. In both cases OH imaging shows that the reaction zone is confined to a narrow region, with the OH field being similar in appearance to that of a single-phase turbulent mixing-controlled (diffusion) flame. Size-classified mean velocity vectors derived from the phase-Doppler data show striking differences in the flow pattern for low and high Stokes number droplets. Droplets 10 μm in diameter and below (Stokes number less than 10) appear to follow the recirculating eddies that provide flame stabilization. Increasing the Weber number by a factor of 2.5 decreased the Sauter mean diameter of the spray by as much as one-third, and the arithmetic mean diameter by as much as one-half. We believe that it is this decrease in the spray droplet diameter that is primarily responsible for the very different flame length in the two cases.

19067 (SAND–91-8718) **Unimolecular reaction mechanisms involving C_3H_4, C_4H_4, and C_6H_6 hydrocarbon species.** Melius, C.F. (Sandia National Labs., Livermore, CA (United States)); Miller, J.A.; Evleth, E.M. Sandia National Labs., Livermore, CA (United States). [1991]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707–5: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92005326. Source: OSTI; NTIS; GPO Dep.

The unimolecular rearrangement processes of unsaturated aliphatic hydrocarbons representative of intermediates in rich hydrocarbon flames have been investigated using the quantum chemical BAC-MP4 method. In particular, we have investigated the unimolecular reaction mechanisms involving (1) allene-cyclopropene-propyne rearrangement, (2) vinylacetylene pyrolysis leading to acetylene and diacetylene, and (3) various C_6H_6 compounds, including 1,5-hexadiyne, 1,2,4,5-hexatetraene, and 1,2-hexadin-5-yne leading to 3,4-dimethylenecyclobutene, fulvene, benzene, 2-ethynyl-1,3-butadiene, and other C_6H_6 species. Rate constants for various reaction steps give food agreement with available experimental measurements. The reaction mechanisms are also consistent with various deuterium isotope labeling experiments. The results indicate that many different types of reaction mechanisms occur, including concerted pathways involving carbene and vinylidene intermediates and insertion reactions of vinylidenes into C-H bonds and C-C multiple bonds. New decomposition pathways are presented for vinylacetylene pyrolysis, for conversion of 1,2-hexadien-5-yne to fulvene, and for conversion of fulvene to benzene.

19068 (SAND-91-8720) **On transient flamelets and their relationship to turbulent methane-air jet flames.** Barlow, R.S. (Sandia National Labs., Livermore, CA (United States)); Chen, J.Y. Sandia National Labs., Livermore, CA (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707-15: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006705. Source: OSTI; NTIS; GPO Dep.

Laminar flame calculations are performed to investigate possible physical mechanisms for the apparent "non-flamelet" behavior that has been measured in turbulent methane-air jet flames. Three factors affecting the structure of methane-air diffusion flames are considered: (1) temporal variation of the scalar dissipation rate, (2) changes in the spatial profile of scalar dissipation, and (3) elimination of differential diffusion by setting all species Lewis numbers to unity. Results indicate that changes in the shape of the scalar dissipation profile and sinusoidal variation of the scalar dissipation have relatively minor effects on species mass fraction profiles. However, significant overshoot of the mass fractions of OH and CO occurs when a flamelet is subjected to a step decrease in scalar dissipation. This overshoot occurs without the flame being first pushed to the brink of extinction, and recovery of the flame to steady-state conditions is relatively slow. Significant changes in species mass fractions also occur when the Lewis numbers are set to unity. 16 refs., 6 figs.

19069 (SAND-91-8732) **The reactions of imidogen with nitric oxide and molecular oxygen.** Miller, J.A.; Melius, C.F. Sandia National Labs., Livermore, CA (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707-13: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006697. Source: OSTI; NTIS; GPO Dep.

Using potential energy surface information from BAC-MP4 calculations and statistical-dynamical methods, we have calculated the branching fraction for the NH + NO reaction, $NH + NO \rightarrow N_2 + H$ (1) $NH + NO \rightarrow N_2O + H$ (2). We find that reaction (2) dominates over the entire temperature range considered, 300 K $< T <$ 3500 K, with $f = k_1/(k_1 + K_2)$ varying from about 0.07 at room temperature to about 0.20 at 3500 K. In addition, we have calculated rate coefficients for the two-channel process, $NH + O_2 \rightarrow HNO + O$ (3) $NH + O_2 \rightarrow NO + OH$ (4). In this case we find that reaction (4) dominates at low temperature, reaction (3) at high temperature. All these results are discussed in terms of the experimental results available and compared with previous theoretical investigations where appropriate. 21 refs., 4 figs., 3 tabs.

19070 (SAND-91-8733) **OH rotational temperature and concentration measurements in a supersonic jet.** Mataga, T.G. (Sandia National Labs., Livermore, CA (United States)); Cattolica, R.J. Sandia National Labs., Livermore, CA (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States); California Univ., Berkeley, CA (United States). DOE Contract AC04-76DR00789. (CONF-920707-10: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006700. Source: OSTI; NTIS; GPO Dep.

Axial and radial profiles of the rotational temperature and concentration of the OH molecule in an axi-symmetric combustion-driven supersonic free jet were measured over a Mach number range from M=1.5 to 7.5 and number density from 10^{12} to 10^{14}cm^{-3}. The free jet was produced from the combustion products of a low-pressure (51.8-torr) H_2/O_2Ar flame (Φ=1.09) expanded from a converging quartz nozzle into a vacuum. The temperature and concentration of the OH molecule were measured via laser-induced fluorescence (LIF) from the $R_1(3)$, $R_1(4)$, and $R_1(7)$ lines in the (1.0) band of the $A\ ^2\Sigma - X\ ^2\Pi$ transition with detection in the (1, 1) band. The temperature was measured using a two-line technique. An empirical model of the fluorescence yield was developed using time-resolved fluorescence quenching rates measured on the jet axis to correct the fluorescence signals for quenching effects. The predicted fluorescence yield increased by a factor of 23 along the jet axis as the temperature decreased from 772 K to 100 K, primarily due to the corresponding decrease in number density for this isentropic expansion. The increase in fluorescence yield due to the density decrease was reduced due to an increase in the collisional cross-section following a $T^{-0.5}$ temperature dependence. The fluorescence yield increased with increasing rotational quantum number. At a temperature of 400 K, the fluorescence yield increased by 30-percent from N′=5 to N′=8. The measured OH rotational temperature and concentration profiles were in good agreement with the predictions of a method of characteristics solution for the behavior of the supersonic free jet. 11 refs., 6 figs., 1 fig.

19071 (SAND-91-8742) **Stochastic simulation of the structure and propagation rate of turbulent premixed flames.** Menon, S. (Quest Integrated, Inc., Kent, WA (United States)); Kerstein, A.R. Sandia National Labs., Livermore, CA (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920707-14: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006682. Source: OSTI; NTIS; GPO Dep.

A stochastic simulation model of the wrinkled flamelet regime of turbulent premixed combustion is shown to exhibit several postulated scaling properties governing flame structure and propagation rate. The model, based on the linear-eddy model of molecular mixing in turbulent flow, incorporates laminar burning of flamelets and the resultant decrease of flame surface area, and flamelet convection and surface area growth due to turbulent stirring. Simulated realization, implemented on a one-dimensional domain representing a longitudinal line through the turbulent flame brush, exhibit (1) linear dependence of the turbulent flame speed u_T on the turbulent velocity fluctuation u', (2) fractal flame structure, and (3) an lower cutoff of fractal scaling that can be plausibly characterized either by the Kolmogorov scale $L_K \sim Re^{-3/4}L$, where Re is the turbulence Reynolds number and L is the integral scale, or by the Gibson sale $L_G \sim (u'/S_L)^3 L$, where S_L is the laminar flame speed. The latter ambiguity indicates that the Re values investigated computationally (up to 1000) are not high enough to fully resolve the high-Re limiting behavior, reflecting an analogous limitation of typical experimental configurations. The experimentally observed decrease of the fractal dimension D at low u'/S_L is reproduced, and is interpreted as reflecting insufficient dynamic range to fully resolve the fractal regime rather than an intrinsic dependence of D on u'/S_L. 14 refs., 4 figs.

19072 (SAND-91-8743) **A linear eddy sub-grid model for turbulent reacting flows: Application to hydrogen-air combustion.** McMurtry, P.A. (Utah Univ., Salt Lake City, UT (United States). Dept. of Mechanical Engineering); Menon, S.; Kerstein, A.R. Sandia National Labs., Livermore, CA (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC04-76DR00789. Contract NAS2-13354. (CONF-920707-11: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92006699. Source: OSTI; NTIS; GPO Dep.

A new sub-grid mixing model for use in large eddy simulations of turbulent combustion is presented and applied to a hydrogen-air diffusion flame. The sub-grid model is based on Kerstein's linear-eddy model. The model is first used to predict the mixing of a conserved scalar in a turbulent shear flow and predict NO formation in hydrogen-air diffusion flame using a reduced chemical mechanism involving nine reactive scalars.

19073 (UCRL-JC–109055) **Shock tube ignition of ethanol, isobutene and MTBE: Experiments and modeling.** Curran, H.J. (University Coll., Galway (Ireland). Dept. of Chemistry); Dunphy, M.P.; Simmie, J.M.; Westbrook, C.K.; Pitz, W.J. Lawrence Livermore National Lab., CA (United States). 22 Nov 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707–19: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92008563. Source: OSTI; NTIS; GPO Dep.

The ignition of ethanol, isobutene and methyl tert-butyl ether (MTBE) has been studied experimentally in a shock tube and computationally with a detailed chemical kinetic model. Experimental results, consisting of ignition delay measurements, were obtained for a range of fuel/oxygen mixtures diluted in Argon, with temperatures varying over a range of 1100–1900 K. The numerical model consisted of a detailed kinetic reaction mechanism with more than 400 elementary reactions, chosen to describe reactions of each fuel and the smaller hydrocarbon and other species produced during their oxidation. The overall agreement between experimental and computed results was excellent, particularly for mixtures with greater than 0.3% fuel. The greatest sensitivity in the computed results was found to falloff parameters in the dissociation reactions of isobutene, ethane, methane, and ethyl and vinyl radicals, to the C_3H_4 and C_3H_5 reaction submechanisms in the model, and to the reactions in the H_2-O_2-Co submechanism.

19074 (UCRL-JC–109083) **Numerical simulation of tulip flame dynamics.** Cloutman, L.D. Lawrence Livermore National Lab., CA (United States). 30 Nov 1991. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707–20: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92008553. Source: OSTI; NTIS; GPO Dep.

A finite difference reactive flow hydrodynamics program based on the full Navier-Stokes equations was used to simulate the combustion process in a homogeneous-charge, constant-volume combustion bomb in which an oddly shaped flame, known as a "tulip flame" in the literature, occurred. The "tulip flame" was readily reproduced in the numerical simulations, producing good agreement with the experimental flame shapes and positions at various times. The calculations provide sufficient detail about the dynamics of the experiment to provide some insight into the physical mechanisms responsible for the peculiar flame shape. Several factors seem to contribute to the tulip formation. The most important process is the baroclinic production of vorticity by the flame front, and this rate of production appears to be dramatically increased by the nonaxial flow generated when the initial semicircular flame front burns out along the sides of the chamber. The vorticity produces a pair of vortices behind the flame that advects the flame into the tulip shape. Boundary layer effects contribute to the details of the flame shape next to the walls of the chamber, but are otherwise not important. 24 refs.

19075 (UCRL-JC–109756) **Two-stage n-butane flame: A comparison between experimental measurements and modeling results.** Corre, C. (Princeton Univ., NJ (United States)); Dryer, F.L.; Pitz, W.J.; Westbrook, C.K. Lawrence Livermore National Lab., CA (United States). Feb 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;FG04-87AL43771. (CONF-920707–25: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92009457. Source: OSTI; NTIS; GPO Dep.

Two stage autoignition processes in unburned end-gases are generally considered to be responsible for homogeneously-initiated engine knock phenomena. Two-stage flame processes were investigated to achieve a better understanding of the low temperature and high temperature chemistry responsible for this type of autoignition behavior. A stabilized n-butane two-stage flame wax numerically simulated, utilizing a detailed kinetic mechanism involving 141 species and 850 elementary reactions, and results are compared with experimental data obtained from a one dimensional, two-stage flame burner. With the exception of those for butenes and hydroperoxyl radicals, calculated and experimental profiles are found to agree within a factor of two over the entire flame region. Under the fuel rich conditions studied, CH_3O and OH radicals are found to be the principal reactive radicals in the cool flame region. A decrease in the estimated rate of reactions $R + HO_2 = RO + OH$ ($R=C_3H_5$, CH_3, C_2H_5 and C_4H_7) is required to obtain agreement of fuel profiles between the two flame zones. In the second stage region, predicted reaction profiles are in general agreement with the experiment, with the exception of formaldehyde and C_4-oxygenated species, for which consumptions are substantially underestimated. This study suggests that the reaction channel for direct metathesis and stabilized hot adduct formation for the overall process $C_4H_9 + O_2 \rightarrow C_4H_8 + HO_2$ need further attention.

19076 (UCRL-JC–109757) **Propane oxidation through the negative temperature coefficient region at 10 and 15 atmospheres: Results of experimental and modeling studies.** Koert, D.N. (Drexel Univ., Philadelphia, PA (United States)); Jaouabi, K.; Miller, D.L.; Cernansky, N.P.; Pitz, W.J.; Westbrook, C.K. Lawrence Livermore National Lab., CA (United States). 10 Dec 1991. 21p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract DAAL03-90-G-0024;Grant CTS-8914756. (CONF-920707–23: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92007902. Source: OSTI; NTIS; GPO Dep.

A detailed chemical kinetic mechanism for propane oxidation has been used to successfully model experimental data through the range of temperatures (650 to 800 K) corresponding to the negative temperature coefficient (NTC) region encountered by engine end-gas just prior to knocking. An important feature of the mechanism is that it models alkylperoxy radical reactions using only uncoupled, parallel reaction paths. The results show that the overall mechanism is most sensitive to changes in the rate of the reactions which produce diperoxy radicals, i.e., that low temperature branching is dominated by decomposition of diperoxy radicals instead of alkylhydroperoxide branching. The calculated concentration versus temperature profiles for all species qualitatively reproduced the NTC behavior indicated by the experimental species data. The fuel consumption and the major produce species, propene and carbon monoxide, were accurately predicted over the entire temperature range. While the calculations accurately reproduced the qualitative behavior of the profiles for the minor species, the concentration levels of these species were generally overpredicted. An attempt was made to model the experimental data using another propane oxidation mechanism which employs a coupled, multichannel unimolecular scheme to model alkylperoxy radical reactions and was found to be unable to reproduce the NTC behavior. However, when a direct path for the reaction $R + O_2 \rightarrow$ olefin $+ HO_2$ was added to the mechanism, NTC behavior emerged. 30 refs., 4 figs., 1 tab.

19077 (VTT-TIED–1282) **Calculation models of wooden beams exposed to fire.** Majamaa, J. (Technical Research Centre of Finland, Espoo (Finland). Fire Technology Lab.). Technical Research Centre of Finland, Espoo (Finland). Sep 1991. 55p. Order Number DE92506492. Source: OSTI; NTIS (US Sales Only).

This study describes a time-to-failure calculation model for wooden beams under a standard fire exposure. The model is based on the linear theory of elasticity by taking the effect of tempemture and moisture on the strength and stiffness of the wood into account. The time-to-failure criterion is a tensile failure in a finger joint (a glu-lam beam) or in a knot. The bending and shear stress distributions in the non-charred wooden cross section are calculated analytically by dividing the cross section into several layers with different material properties. The bending moment and shear capacity are then calculated by summing the capacities of the layers. Finally, the calculation is compared with test results. Beams are assumed to be of rectangular cross section and exposed to fire on three or four sides. Some earlier calculation methods are briefly reviewed.

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Refer also to citation(s) 20625

19078 (EGG-ME-9968) **Reliability in the design phase.** Siahpush, A.S. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Hills, S.W.; Pham, H.; Majumdar, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012217. Source: OSTI; NTIS; INIS; GPO Dep.

A study was performed to determine the common methods and tools that are available to calculated or predict a system's reliability. A literature review and software survey are included. The desired product of this developmental work is a tool for the system designer to use in the early design phase so that the final design will achieve the desired system reliability without lengthy testing and rework. Three computer programs were written which provide the first attempt at fulfilling this need. The programs are described and a case study is presented for each one. This is a continuing effort which will be furthered in FY-1992. 10 refs.

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Refer also to citation(s) 17914, 17917, 17971, 17983, 17994, 18006, 18035, 18051, 18067, 18079, 18080, 18086, 18112, 18115, 18322, 18418, 18571, 18726, 18730, 18741, 18747, 18749, 18759, 18885, 19223, 19367, 19386, 19387, 19398, 19443, 20617

19079 (ANL/CP-75215) **Seismic qualification of existing safety class manipulators.** Wu, Ting-shu; Moran, T.J. Argonne National Lab., IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920631-27: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92012653. Source: OSTI; NTIS; INIS; GPO Dep.

There are two bridge type electromechanical manipulators within a nuclear fuel handling facility which were constructed over twenty-five years ago. At that time, there were only minimal seismic considerations. These manipulators together with the facility are being reactivated. Detailed analyses have shown that the manipulators will satisfy the requirements of ANSI/AISC N690-1984 when they are subjected to loadings including the site specific design basis earthquake. 4 refs.

19080 (CONF-920417-3) **History of remote operations and robotics in nuclear facilities: Robotics and Intelligent Systems Program.** Herndon, J.N. Oak Ridge National Lab., TN (United States). [1992]. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From ANS executive conference on remote operations and robotics in the nuclear industry II; Pine Mountain, GA (United States); 5-8 Apr 1992. Order Number DE92011772. Source: OSTI; NTIS; INIS; GPO Dep.

The field of remote technology is continuing to evolve to support man's efforts to perform tasks in hostile environments. Remote technology has roots which reach into the early history of man. Fireplace pokers, blacksmith's tongs, and periscopes are examples of the beginnings of remote technology. The technology which we recognize today has evolved over the last 45-plus years to support human operations in hostile environments such as nuclear fission and fusion, space, underwater, hazardous chemical, and hazardous manufacturing. The four major categories of approach to remote technology have been (1) protective clothing and equipment for direct human entry, (2) extended reach tools using distance for safety, (3) telemanipulators with barriers for safety, and (4) teleoperators incorporating mobility with distance and/or barriers for safety. The government and commercial nuclear industry has driven the development of the majority of the actual teleoperator hardware available today. This hardware has been developed due to the unsatisfactory performance of the protective-clothing approach in many hostile applications. Systems which have been developed include crane/impact wrench systems, unilateral power manipulators, mechanical master/slaves, and servomanipulators. Work for space applications has been primarily research oriented with few successful space applications, although the shuttle's remote manipulator system has been successful. In the last decade, underwater applications have moved forward significantly, with the offshore oil industry and military applications providing the primary impetus. This document consists of viewgraphs and subtitled figures.

19081 (CONF-920724-1) **Using custom-designed VLSI fuzzy inferencing chips for the autonomous navigation of a mobile robot.** Pin, F.G. (Oak Ridge National Lab., TN (United States)); Pattay, R.S.; Watanabe, Hiroyuki; Symon, J. Oak Ridge National Lab., TN (United States). [1991]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 Institute of Electrical and Electronic Engineers (IEEE) international conference on intelligent robots and systems; Raleigh, NC (United States); 7-10 Jul 1992. Order Number DE92000424. Source: OSTI; NTIS; GPO Dep.

Two types of computer boards including custom-designed VLSI fuzzy inferencing chips have been developed to add a qualitative reasoning capability to the real-time control of autonomous mobile robots. The design and operation of these boards are first described and an example of their use for the autonomous navigation of mobile robot is presented. The development of qualitative reasoning schemes emulating human-like navigation in apriori unknown environments is discussed. An approach using superposition of elemental sensor-based behaviors is shown to alloy easy development and testing of the inferencing rule base, while providing for progressive addition of behaviors to resolve situations of increasing complexity. The efficiency of such schemes, which can consist of as little as a dozen qualitative rules, is illustrated in experiments involving an autonomous mobile robot navigating on the basis of very sparse and inaccurate sensor data. 17 refs., 6 figs.

19082 (CONF-920724-2) **Terrain following of arbitrary surfaces using a high intensity LED proximity sensor.** Baker, J.E. Oak Ridge National Lab., TN (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 Institute of Electrical and Electronic Engineers (IEEE) international conference on intelligent robots and systems; Raleigh, NC (United States); 7-10 Jul 1992. Order Number DE92004464. Source: OSTI; NTIS; GPO Dep.

Many robotic operations, e.g., mapping, scanning, feature following, etc., require accurate surface following of arbitrary targets. This paper presents a versatile surface following and mapping system designed to promote hardware, software and application independence, modular development, and upward expandability. These goals are met by: a full, a priori specification of the hardware and software interfaces; a modular system architecture; and hierarchical surface-data analysis method, permitting application specific tuning at each conceptual level of topological abstraction. This surface following system was fully designed and implemented independently of any specific robotic host, then successfully integrated with and demonstrated on a completely a priori unknown, real-time robotic system.

19083 (DP-MS-89-1292) **Efficiency and mass loading characteristics of a typical HEPA [High Efficiency Particulate Air] filter media material.** Novick, V.J. (Argonne National Lab., IL (USA)); Higgins, P.J.; Dierkschiede, B.; Abrahamson, C.; Richardson, W.B.; Monson, P.R.; Ellison, P.G. Argonne National Lab., IL (United States). [1990]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;AC09-89SR18035. (CONF-900809-4: 21. Department of Energy/Nuclear Regulatory Commission (DOE/NRC) nuclear air cleaning conference, San Diego, CA (United States), 13-16 Aug 1990). Order Number DE90017796. Source: OSTI; NTIS; GPO Dep.

The particle removal efficiency of the HEPA filter material used at the Savannah River Site was measured as a function of monodisperse particle diameter and two gas filtration velocities. The results indicate that the material meets or exceeds the minimum specified efficiency of 99.97% for all particle diameters at both normal and minimum operating flow conditions encountered at the Savannah River site. The pressure drop across the HEPA filter material used at the Savannah River site was measured as a function of particle mass loading for various aerosol size distributions.The pressure drop was found to increase linearly with the particle mass loaded onto the filters, as long as the particles were completely dry. The slope of the curve was found to be dependent on the particle diameter and velocity of the aerosol. The linear behavior between the initial pressure drop (clean filter) and the final pressure drop (loaded filter) implies that the filtration mechanism is dominated by the particle cake that rapidly forms on the front surface of the HEPA filter. This behavior is consistent with the high filtration efficiency of the material. 16 refs., 14 figs.

19084 (EGG-NE-9768) **Criticality safety evaluation of Rocky Flats Plant one-gallon shipping containers.** Shaw, M.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012323. Source: OSTI; NTIS; INIS; GPO Dep.

Criticality safety calculations have been performed to provide an analytical basis for handling, storage and transport of Rocky Flats Plant (RFP) one-gallon shipping containers. A mass limit was establish for metal (solid uranium or plutonium) and slurries (undissolved U or Pu solids in a "mud," "sludge," or "slurry"). A separate volume limit was developed for plutonium solutions (liquids, either aqueous or organic, containing no visible undissolved solids).

19085 (ENEA-RTI-NUC-IMP--91-02) **Radioactive and toxic-noxious waste containers: Italian application of UNI norm.** Costalunga, R.; Dell'Arena, N.; Di Pace, L.; Fiorotto, R.; Musso, L. ENEA, Casaccia (Italy). Nov 1991. 18p. (In Italian). (RTI/NUC-IMP--91-02). Order Number DE92506283. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the fabrication and testing, by Casagrande Spa, a medium sized Italian manufacturing firm, of reinforced concrete containers (2.34 m diameter, 3.04 m height, 9 cubic meter internal volume, 10.5 tonne weight) for radioactive and toxic-noxious wastes. The containers were fabricated and quality assured according to the specifications of UNI (Italian National Industrial Standardization) EN Normative 29003. In particular, the paper focuses on the program management activities performed by ENEA (Italian National Agency for New Technologies, Energy and Environment), the purchasing agent for these containers.

19086 (ETDE-IT--92-36) **Radioactive and toxic-noxious waste containers: Italian UNI norm governing supplier-purchaser relationship.** Costalunga, R.; Dell'Arena, N.; Di Pace, L.; Fiorotto, R.; Musso, L. ENEA, Casaccia (Italy). 1991. 15p. (In Italian). (CONF-9111218--1: I sistemi di qualificazione e certificazione: la normativa ISO 9000, Rome (Italy), 29 Nov 1991). Order Number DE92506287. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the the application of the UNI (Italian National Industrial Standardization) EN Normative 29003 governing the fabrication and testing of reinforced concrete containers for the transport and storage of radioactive and toxic-noxious wastes. The normative contains complete instructions regarding the contents of contracts to be made between the manufacturer and the purchasing agent, as well as, regarding the modality of the fulfilment of contractual obligations. The normative was applied in the fabrication, by Casagrande Spa., a medium sized Italian manufacturing firm, of reinforced concrete containers (2.34 m diameter, 3.04 m height, 9 cubic meter internal volume, 10.5 tonne weight). The contract management activities, including testing and quality assurance, were performed by ENEA (Italian National Agency for New Technologies, Energy and Environment), the purchasing agent for these containers.

19087 (KCP--613-4503) **Computer-aided modeling tools for forging process feasibility studies: Progress report No. 3.** El-Gizawy, A.S. (Missouri Univ., Columbia, MO (United States). Dept. of Mechanical and Aerospace Engineering). Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div.; Missouri Univ., Columbia, MO (United States). Dept. of Mechanical and Aerospace Engineering. Mar 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012116. Source: OSTI; NTIS; GPO Dep.

Equations were developed to express stress distributions for a variety of deformation configurations. Strain equations were developed as they apply to forged workpieces, as were strain rate equations. The flow stress equation was introduced. The shear criterion was established to minimize the amount of energy that deforming metal flow consumes. An equation was developed relating flash width and thickness using the concept of constant volume. Force equations were developed for lateral and converging flow. From these equations, the closed-die axisymmetric forging process was simulated in two cases: constant ram speed and constant strain rate. Fortran programs were developed for both cases. Software employed to present on-screen interactive graphics was FIGARO by MEGATEK. The feasibility of producing a particular part was studied by comparing net shape, near net shape, and conventional forging/machining methods. A near net shape design with some machining was recommended as most economical.

19088 (KCP--613-4547) **Erosion of stainless steel by ultrasonic cleaning: A preliminary study.** Harding, W.B. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92012566. Source: OSTI; NTIS; GPO Dep.

The erosion of stainless steel during ultrasonic cleaning was measured using several ultrasonic frequencies and powers and several water-based and solvent cleaning liquids.

19089 (MLM--3738) **Process capability of fineblanked cover diameters for the timer program.** Helgerson, J.A. Mound, Miamisburg, OH (United States). 17 Mar 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-88DP43495. Order Number DE92011700. Source: OSTI; NTIS; GPO Dep.

This report discusses the differences, relative to diameter, between stamping and fineblanking stainless steel covers for a timer component. The results will show that fineblanking is a superior method of producing the covers while maintaining dimensional control.

19090 (NUREG--1419) **Directory of Certificates of Compliance for dry spent fuel storage casks.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety. Feb 1992. 51p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This directory contains Certificates of Compliance for all dry spent fuel storage casks approved by the US Nuclear Regulatory Commission and Summary Reports of each approved cask model. Later directories will contain a list of cask users, and a list of cask locations. The purpose of this directory is to make available a convenient source of information on spent fuel storage casks which have been approved by the US Nuclear Regulatory Commission. Storage of fuel assemblies using these casks must be in accordance with the provisions of 10 CFR Part 72.

19091 (PNL--8053) **Beam-powered lunar rover design.** Dagle, J.E.; Coomes, E.P.; Antoniak, Z.I.; Bamberger, J.A.; Bates, J.M.; Chiu, M.A.; Dodge, R.E.; Wise, J.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 45p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011511. Source: OSTI; NTIS; GPO Dep.

Manned exploration of our nearest neighbors in the solar systems is the primary goal of the Space Exploration Initiative (SEI). An integral part of any manned lunar or planetary outpost will be a system for manned excursions over the surface of the planet. This report presents a preliminary design for a lunar rover capable of supporting four astronauts on long-duration excursions across the lunar landscape. The distinguishing feature of this rover design is that power is provided to rover via a laser beam from an independent orbiting power satellite. This system design provides very high power availability with minimal mass on the rover vehicle. With this abundance of power, and with a relatively small power-system mass contained in the rover, the vehicle can perform an impressive suite of mission-related activity. The rover might be used as the first outpost for the lunar surface (i.e., a mobile base). A mobile base has the advantage of providing extensive mission activities without the expense of establishing a fixed base. This concept has been referred to as "Rove First." A manned over, powered through a laser beam, has been designed for travel on the lunar surface for round-trip distances in the range of 1000 km, although the actual distance traveled is not crucial since the propulsion system does not rely on energy storage. The life support system can support a 4-person crew for up to 30 days, and ample power is available for mission-related activities. The 8000-kg rover has 30 kW of continuous power available via a laser transmitter located at the Earth-moon L1 libration point, about 50,000 km above the surface of the moon. This rover, which is designed to operate in either day or night conditions, has the flexibility to perform a variety of power-intensive missions. 24 refs.

19092 (SAND–90-3111C) **A validated methodology for evaluating burnup credit in spent fuel casks.** Brady, M.C. (Oak Ridge National Lab., TN (United States)); Sanders, T.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC05-84OR21400. (CONF-910993–20: International conference on nuclear criticality (ICNC) safety, Oxford (United Kingdom), 9-13 Sep 1991; TTC–1039). Order Number DE92011385. Source: OSTI; NTIS; INIS; GPO Dep.

The concept of allowing reactivity credit for the transmuted state of spent fuel offers both economic and risk incentives. This paper presents a general overview of the technical work being performed in support of the US Department of Energy (DOE) program to resolve issues related to the implementation of burnup credit. An analysis methodology is presented along with information representing the validation of the method against available experimental data. The experimental data that are applicable to burnup credit include chemical assay data for the validation of the isotopic prediction models, fresh fuel critical experiments for the validation of criticality calculations for various casks geometries, and reactor restart critical data to validate criticality calculations with spent fuel. The methodology has been specifically developed to be simple and generally applicable, therefore giving rise to uncertainties or sensitivities which are identified and quantified in terms of a percent bias in k_{eff}. Implementation issues affecting licensing requirements and operational procedures are discussed briefly.

19093 (SAND–91-1704C) **Orbital debris characterization with impact flash signatures.** Ang, J.A. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9103235–1: American Institute of Aeronautics and Astronautics (AIAA) space programs and technologies conference, Huntsville, AL (United States), 24-27 Mar 1991). Order Number DE92010666. Source: OSTI; NTIS; GPO Dep.

Orbital debris is recognized as a serious and growing threat to man's utilization and exploration of space. While some information is available on the material composition of orbital debris, most measurements of orbital debris size and velocity distributions do not distinguish material type. The analysis and understanding of impact flash signatures can lead to an in-situ detector system with the ability to determine size and impact velocity distribution for orbital debris segregated by material type. This detector concept is based on an understanding of how material shock properties govern the flash signature arising from the impact of a piece of orbital debris (impactor) against a witness plate (target). Analytical results are presented that identify the most promising witness plate materials with respect to producing impact flash signatures that characterize the orbital debris material. 7 refs.

19094 (SAND–91-1717C) **Evaluation of Whipple bumper shields at 7 and 10 km/s.** Ang, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Chhabildas, L.C.; Cour-Palais, B.G.; Christiansen, E.L.; Crews, J.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920373–3: American Institute of Astronautics and Aeronautics (AIAA) space programs and technologies conference, Huntsville, AL (United States), 24-27 Mar 1992). Order Number DE92010663. Source: OSTI; NTIS; GPO Dep.

A series of experiments has been performed on the Sandia Hypervelocity Launcher to determine the performance limits of conventional Whipple shields against representative 0.8 g aluminum orbital debris plate-like fragments with velocities of 7 and 10 km/s. Supporting diagnostics include flash X-rays, high speed photography and transient digitizers for timing correlation. Two Whipple shield designs were tested with either a 0.030 cm or a 0.127 cm thick front sheet and a 0.407 cm thick backsheet separated by 30.5 cm. These two designs bracket the ballistic penetration limit curve for protection against these debris simulants for 7 km/s impacts. 7 refs.

19095 (SAND–91-2350C) **Torque linearizing hardware for the electric joint motors of a direct-drive robot.** Muir, P.F.; Bryan, J.R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205141–2: Ideas in science and electronics (ISE) symposium, Albuquerque, NM (United States), 14 May 1992). Order Number DE92012681. Source: OSTI; NTIS; GPO Dep.

Many emerging high-performance robot control algorithms require the command of the joint torques; yet no known commercial robots provide such a capability. In this paper, we describe the design, development, testing and application of a VMEbus-based torque linearizing joint interface board (JIB). One JIB resides between the robot control processor and each joint motor amplifier. The JIB provides the control processor with the capability to read the motor position and apply accurate motor torques. The torque command capability derives from the application of a 128k x 8 EPROM lookup table for each motor phase. Because joint motor torque is dependent upon the torque command and the motor position, the hardware is designed to utilize the torque command and the current motor position as the address to retrieve the proper pulse-width for the PWM motor amplifier. The table look-up cycle operates independently of the robot controller at a 40KHz rate to provide constant joint torque as the motor rotates. We identify the proper table entries by an automated in situ data collection procedure. Static torque generation results show that the torque deviations are reduced from as much as 76% to below 5% for each of the three direct-drive motors (two are variable reluctance motors and one is brushless DC) on an AdeptTwo robot. These torque deviations are reduced below 2.5% if only the upper 90% of the torque range is considered. The torque deviations of the non-direct-drive joint are reduced by 50%. Dynamic robot edge following experiments show that the robot speed of operation can be more than doubled for a given applied force accuracy by utilizing the joint torque linearizing boards. 8 refs.

19096 (SAND–91-2808C) **Improving path planning with learning.** Chen, P.C. Sandia National Labs., Albuquerque, NM (United States). 16 Dec 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920740–1: 9. international machine learning conference, Aberdeen (United Kingdom), 1-3 Jul 1992). Order Number DE92004360. Source: OSTI; NTIS; GPO Dep.

We present a learning algorithm designed to improve robot path planning. The algorithm relies on an existing path planner to provide solutions to difficult tasks. From these solutions, it learns a sparse network of useful robot subgoals which guide and support fast planning. We analyze the algorithm theoretically by developing some general techniques useful in characterizing behaviors of probabilistic learning. We also demonstrate the effectiveness of the algorithm empirically with an existing path planner in practical environments. The learning algorithm not only reduces the time cost of existing planners, but also increases their capability in solving difficult tasks. 7 refs.

19097 (SAND–92-0457) **Techniques for autonomous navigation.** Byrne, R.H.; Klarer, P.R.; Pletta, J.B. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013458. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Based on the growing need to develop physical security systems which are more flexible and less manpower intensive, the US Army has defined the Required Operational Capability (ROC) for a Mobile Detection Assessment Response System (MDARS). This report evaluates potential technical approaches for implementing the portion of the MDARS robotic path-following system. To address the wide range of available technologies, the report is broken into two main sections, path sensing and position location. Path sensing techniques discussed include: vision, ultrasonic ranging, scanning lasers, inductive wire-following, and stripe-following. Position location systems covered include: CPS, Loran-C, Omega, transit, RF beacons, and laser reflectors. A cost-risk trade-off analysis of the systems described is provided along with recommendations on the best technical approach to meet the MDARS path-following requirements using proven technology.

19098 (SAND–92-0493) **Eulerian simulation of the perforation of aluminum plates by nondeforming projectiles.** Silling, S.A. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011515. Source: OSTI; NTIS; GPO Dep.

A new algorithm for the treatment of sliding interfaces between solids with or without friction in an Eulerian wavecode is described. The algorithm has been implemented in the two-dimensional version of the CTH code. The code was used to simulate penetration and perforation of aluminum plates by rigid, conical-nosed tungsten projectiles. Comparison with experimental data is provided.

19099 (SAND–92-0662C) **A simple approach for the design and optimization of stand-off hypervelocity particle shields.** Lawrence, R.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920373–4: American Institute of Astronautics and Aeronautics (AIAA) space programs and technologies conference, Huntsville, AL (United States), 24-27 Mar 1992; AIAA–92-1465). Order Number DE92011383. Source: OSTI; NTIS; GPO Dep.

We describe a simple engineering model applicable to stand-off "Whipple bumper" shields, which are used to protect space-based assets from impacts by orbital debris particles. The model provides a framework for analyzing: (1) the parameter limits governing the penetration and breakup or decomposition of the hypervelocity debris particle; (2) the behavior of the induced debris cloud, including its velocity and divergence; and (3) the design and optimization of the stand-off shield for a specific threat and level of protection required. The model is normalized to actual stand-off debris shield experiments and multi-dimensional numerical simulations at impact velocities of ~ km/s. The subsequent analysis of a current space station shield design suggests that: (1) for acceptable levels of protection, stand-off shields can be significantly thinner than previously thought; and (2) with the proper balance between shield thickness and stand-off distance, the total shield mass can be reduced substantially. 16 refs.

19100 (UCRL–52000-91-11) **Energy and Technology Review, November 1991.** Sefcik, J.A.; de Vore, L.; Gleason, K.; Kroopnick, H.; Sanford, N.M. (eds.). Lawrence Livermore National Lab., CA (United States). Nov 1991. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011739. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory, operated by the University of California for the United States Department of Energy, was established in 1952 to do research on nuclear weapons and magnetic fusion energy. Since, then we have added other major programs, including laser fusion and laser isotope separation, biomedical and environmental science, strategic defense, and applied energy technology. These programs, in turn, require research in basic scientific disciplines, including chemistry and materials science, computer science and technology, engineering, and physics. Energy and Technology Review is published monthly to report on unclassified work in all our programs. Topics covered in this issue are: (1) Earthquake safety: How safe is LLNL? Over the last decade, we have made a major effort to ensure the safety of Laboratory employees and facilities in the events of an earthquake. With completion of the structural upgrade for Building 111, the Laboratory may now be one of the most earthquake-ready research and the development complexes in the Bay Area; however, our efforts to ensure an earthquake safe environment at the Laboratory continue. (2) Assessing the effects of earthquakes and other natural disasters before they strike. Although scientists and engineers in LLNL's Nuclear Systems Safety Program may not able to predict an earthquake or other natural disaster, they can now do the next best thing-they can assess the probable hazards of a natural disaster at any location in the country. (3) A strategy for smoothly transitioning to massively parallel computing. We have recently demonstrated that massively parallel processors are becoming hospitable to general-purpose computing and that codes written initially for vector processors can be transported smoothly to and run effectively on these new machines.

19101 (UCRL-ID–107571) **Capabilities of the 3-axes modified FP42 Deckel milling machine: R program, laser engineering and materials.** Villarreal, E. Lawrence Livermore National Lab., CA (United States). May 1991. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011737. Source: OSTI; NTIS; GPO Dep.

This report is a technical guide containing information on the design and performance of the modified FP42 Deckel milling machine (MFD id. no. M362) and associated tooling used in conjunction with the Deckel. The main modification consists of an aluminum head assembly bolted to the Deckel headstock. The head assembly supports two milling spindles. The spindles may be oriented in the X, Y and Z coordinate axes. The associated tooling includes a tool set station and precision workpiece clamping base.

19102 (UCRL-ID–109127) **Garnet separation system water jet cutter B321 Weld Shop, MFD.** Vercelli, T.M. Lawrence Livermore National Lab., CA (United States). Dec 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012394. Source: OSTI; NTIS; GPO Dep.

Presently there is one Water Jet cutter in use in the B321 Weld Shop with the possibility of one to three more jet machines being installed in the near future. The water jet machine uses a high pressure water jet to cut various materials. Depending on the material to be cut a garnet abrasive is sometimes added to the water jet to enhance it's cutting capability. The jet is captured in a water bath tank below the cutting surface. The water bath absorbs the energy of the water jet while acting as a collection tank for the water and garnet emitting from the water jet nozzle, and any excess material and kerff from the cutting operation. The garnet and excess material must be removed from the tank periodically. The method of water and garnet separation is inefficient, requires manual operation, does not control the water level in the water bath tank, and requires weekly filter changes. The original system is replaced by automatic continuous recirculating water-garnet separation system. The system pumps the water and garnet from the water bath tank through a "Hydrocyclone Separator" and back to the water bath tank. This system is capable of depositing the garnet into 55 gallon drums while automatically separating the garnet from the water. This eliminates having to manually shovel the garnet from the water bath tank, reduces filter changes, reduces machines down time, and automatically maintains the water level of the water bath tank. This document describes the design details of this system.

19103 (UCRL-JC–108503) **1 MJ electric gun facility at LLNL.** Lee, R.S.; Osher, J.E.; Chau, H.H.; Pomykal, G.; Speer, R.D. Lawrence Livermore National Lab., CA (United States). Feb 1992. 6p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9204102–5: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92010440. Source: OSTI; NTIS; GPO Dep.

Since the early 1970's LLNL has used devices which we call electric guns to accelerate thin flyer plates to hypervelocities. These devices use a capacitor bank to electrically explode a thin metal foil. The explosion of the foil drives a thin plate, placed on top of the foil, to velocities up to 18 km/s. This paper describes the latest step in the evolution of these devices, a 1 MJ electric gun system. The primary motivation for building this electric gun system was to throw large-area, thin-plate impactors with area up to 930 cm^2.

19104 (UCRL-JC–109918-Rev.1) **Preliminary cutting and drilling studies using new generation lasers: Revision 1.** Kautz, D.D.; Sze, J.S.; Dragon, E.P.; Hargrove, R.S. Lawrence Livermore National Lab., CA (United States). 20 Feb 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911296–8-Rev.1: Lasers '91, San Diego, CA (United States), 8-13 Dec 1991). Order Number DE92010712. Source: OSTI; NTIS; GPO Dep.

High power and radiance dye lasers developed at Lawrence Livermore National Laboratory show promise for material processing tasks. Evaluation using welding heat flow models suggests significant increases in precision and speed are expected. We developed tooling and instrumentation to diagnose important parameters including spot geometry and optical train quality. We started processing studies to determine the viability of these lasers for cutting and drilling. We used titanium and stainless steel alloys for testing due to the availability of comparable parametric studies in the technical literature. Results show that cuts and holes with extremely fine features can be made with dye lasers. The high radiance beam produces low distortion and small heat-affected zone. We have accomplished very high aspects ratios and micron scale kerfs and holes. Through continued system improvement and process optimization, we believe that submicron levels will be realized.

19105 (UCRL-LR-109428) **Free vibration of thick isotropic and orthotropic cylindrical shells.** Bumpas, S.E. Lawrence Livermore National Lab., CA (United States). Aug 1991. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011653. Source: OSTI; NTIS; GPO Dep.

The vibration of free, thick cylindrical shells that are composed of either isotropic materials or orthotropic materials like modern composite laminates are studied. The formulation starts with an approximate five-term displacement field that has been used previously. The subsequent approximate strains, stresses, and force and moment resultants are successively substituted into a variational form of Hamilton's principle to yield the governing vibration equations and boundary condition equations. The two sets of equations are solved simultaneously to obtain dimensionless frequencies. The constitutive law for the material is assumed to be orthogonal with respect to the mid-surface coordinate system. Explicit shear coefficients are assumed for all resultants that have a shear stress in their definition. The computer algorithm that solves the equations is explained along with the exception testing for any found frequency. Results mainly consist of contour plots of the first fundamental frequency for a particular circumferential wave number, n, and symmetric or antisymmetric form. Differences with an accurate series solution for the isotropic case are given. Through-thickness shear coefficients are found that would make this formulation agree with the isotropic series solution. A study of higher frequencies is presented and favorably compared to the series solution. Two typical sets of results are presented for orthotropic materials representative of composite laminates that are stiff in the longitudinal and tangential directions. A concluding summary and areas of future work are discussed. 29 refs.

19106 (UCRL-LR-109784) **Analysis and optimization of low-earth-orbit communication links.** Corynen, G.C.; Glaser, R.E. Lawrence Livermore National Lab., CA (United States). Apr 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013393. Source: OSTI; NTIS; GPO Dep.

We have completed the development and testing of an algorithm for modeling, analyzing, and optimizing physical aspects of individual laser links in a low-earth-orbit (LEO) communication system. Called NETLINK, the algorithm provides a highly parametrized test bed for confirming system requirements and exploring design alternatives. Although NETLINK is currently configured as a probability processor that computes and propagates probabilities and statistical parameters directly, with minor modifications it can serve as a Monte Carlo simulator where only individual random samples are processed. A simplified form of the algorithm is also intended as a prototype for producing onboard real-time link performance predictions that will be required at the network level to achieve optimal routing and configuration protocols. Our NETLINK software is implemented in the C language, in which network nodes are conventionally represented as structures. These are used to account for detailed dynamic, geometric, and statistical attributes of individual network nodes and for various random and systematic (bias) errors in the associated acquisition, tracking, and pointing (ATP) system. To achieve both mathematical rigor and computational efficiency, we incorporated advanced numerical techniques. We have obtained useful results with NETLINK. For example, a laser peak power of about 40 watts seems adequate to achieve a link reliability of 0.999 (i.e., a message error rate of 0.001) over a communication range of 10 to 2000 km. Moreover, link reliability inside the acceptable range interval also appears better than currently believed. Our results also show that on-line detector threshold optimization is both practical and useful, although it is not necessary if communication distances are limited to the interval 20 to 200 km, in which the optimal threshold is 2960 counts. In using the algorithm to optimize message header structure, we found the optimal header length to be four frames.

19107 (WHC-SA-1396) **Radioactive material packaging performance testing.** Romano, T. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920631-20: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92012656. Source: OSTI; NTIS; INIS; GPO Dep.

In an effort to provide uniform packaging of hazardous material on an international level, recommendations for the transport of dangerous goods have been developed by the United Nations. These recommendations are performance oriented and contrast with a large number of packaging specifications in the US Department of Transportation's hazard materials regulations. This dual system presents problems when international shipments enter the US Department of Transportation's system. Faced with the question of continuing a dual system or aligning with the international system, the Research and Special Programs Administration of the US Department of Transportation responded with Docket HM-181. This began the transition toward the international transportation system. Following close behind is Docket HM-169A, which addressed low specific activity radioactive material packaging. This paper will discuss the differences between performance-oriented and specification packaging, the transition toward performance-oriented packaging by the US Department of Transportation, and performance-oriented testing of radioactive material packaging by Westinghouse Hanford Company. Dockets HM-181 and HM-169A will be discussed along with Type A (low activity) and Type B (high activity) radioactive material packaging evaluations.

19108 (WSRC-MS-90-139) **Rapid heating tensile tests of solution-annealed Incoloy 903 charged with hydrogen and tritium.** Mosley, W.C. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9005165-3: 6. meeting of Interagency Mechanical Operations Group (IMOG), Amarillo, TX (United States), 1-3 May 1990). Order Number DE92010998. Source: OSTI; NTIS; INIS; GPO Dep.

Rapid heating tensile tests from room temperature to above 1000°C have been performed on specimens of solution-annealed Incoloy 903 charged with hydrogen and tritium. Absorbed hydrogen had very little effect on tensile properties. Internal helium from radioactive decay of absorbed tritium drastically decreased ductility above 700°C.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 18243, 18422, 18430, 19380, 20292

19109 (DOE/ER/13911-T2) **Transport properties of multicomponent fluids and of suspensions: Annual progress report, June 15, 1988–June 14, 1989.** Oppenheim, I.; McBride, J. Science Applications International Corp., San Diego, CA (United States). 15 Sep 1989. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER13911. (SAIC-89/1570-APPAT-115). Order Number DE92012574. Source: OSTI; NTIS; GPO Dep.

This report describes work performed under grant No. DE-FG03-88ER13911 for the period June 15, 1988 through June 14, 1989. During this time, significant progress was made in the derivation of the fundamental equations describing suspensions and multicomponent fluid flow. We first considered a system consisting of spherical heavy (Brownian) particles immersed in a bath of spherical particles. The deviations of the bath from equilibrium are due to the nonequilibrium motions of the Brownian particles. The densities of the bath and of a Brownian particle are similar. An expansion in powers of the mass ratio, yields a Fokker-Planck equation for the distribution function of the Brownian particles, including the effects of direct and hydrodynamic interactions amongst these particles. The effect of the Brownian particle motion on the bath properties has been described. The conditions under which a closed equation for the coordinate space distribution function, can be obtained have been investigated and a Smoluchowski equation for this quantity has been derived.

19110 (KFK--4948) **A three-field model of transient 3D multiphase, three-component flow for the computer code IV A3. Pt. 1. Theoretical basis: Conservation and state equations. Numerics.** Kolev, N.I. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. Dec 1991. 108p. Order Number DE92511593. Source: OSTI; NTIS (US Sales Only); INIS.

This work contains description of the physical and mathematical basis on which the IVA3 computer code relies. After describing the state of the art of the 3D modeling for transient multiphase flows, the model assumptions and the modeling technique used in IVA3 are described. Starting with the principles of conservation of mass, momentum, and energy, the non averaged conservation equations are derived for each of the velocity fields which consist of different isothermal components. Thereafter averaging is applied and the working form of the system of 21 partial differential equations is derived. Special attention is paid to the strict consistence of the modeling technique used in IVA3 with the second principle of thermodynamics. The entropy concept used is derived starting with the unaveraged conservation equations and subsequent averaging. The source terms of the entropy production are carefully defined and the final form of the averaged entropy equation is given ready for direct practical applications. The idea of strong analytical thermodynamic coupling between pressure field and changes of the other thermodynamic properties, which is used for the first time in 3D multi fluid modeling, is presented in detail. After obtaining the working form of the conservation equations, the discretization procedure and the reduction to algebraic problems is presented. The mathematical solution method together with some information about the architecture of IVA3 including the local momentum decoupling and accuracy control is presented too. (orig./GL).

19111 (KFK--4949) **A three-field model of transient 3D multiphase, three-component flow for the computer code IV A3. Pt. 2. Models for the interfacial transport phenomena. Code validation.** Kolev, N.I. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. Dec 1991. 139p. Order Number DE92511592. Source: OSTI; NTIS (US Sales Only); INIS.

The second part of the IVA3 code description contains the constitutive models used for the interfacial transport phenomena and the code validation results. First 20 flow patterns are defined and the transition criteria are discussed. The dynamic fragmentation and coalescence models used in IVA3 are documented. After the description of the models for predicting the flow patterns and flow structure sizes the models for the interfacial mechanical interaction are described. Finally the models for interfacial heat and mass transfer are given with emphasis on the time averaging of the heat and mass source terms. The code validation passes several stages from simple tests on well known benchmarks trough simulation of one-, two-, and three-phase flows in simple and complicated geometries. The gradually increase of the complexity and the successful comparison of the predictions with experimental data is the main characteristic of the verification procedure. It is demonstrated by several examples that IVA3 is a powerful tool for three-fluid modelling of complicated three-phase flows in complex geometry with strong thermal and mechanical interaction between the velocity fields. (orig.).

19112 (LA-UR--92-756) **On the hot-spot-controlled critical heat flux mechanism in pool boiling of saturated fluids.** Unal, C.; Sadasivan, P.; Nelson, R.A. Los Alamos National Lab., NM (United States). [1992]. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9203122--2: Engineering Foundation conference on pool and external flow boiling, Santa Barbara, CA (United States), 22-27 Mar 1992). Order Number DE92011352. Source: OSTI; NTIS; GPO Dep.

In this paper, we further investigate the hypothesis that the critical heat flux (CHF) occurs when some point on the heated surface reaches a high enough temperature that liquid can no longer contact that point, resulting in a gradual but continuous increase in the overall surface temperature. This hypothesis unifies the occurrence of the CHF and the quenching of hot surfaces by relating both to the same concept, i.e., the ability of a liquid to contact a hot surface. We use a two-dimensional transient conduction model to study the boiling phenomenon in the second transition region of saturated pool nucleate boiling on a horizontal surface. The heater surface is assumed to consist of two regions: a dry patch region formed as a result of complete evaporation of the thinner liquid macrolayers and a two-phase macrolayer region formed by numerous vapor stems penetrating relatively thick liquid macrolayers. The constitutive relations used to determine the stem-macrolayer configuration in the two-phase macrolayer region of the boiling surface were reevaluated for Gaertner's clean water and water-nickel/salt solution. 29 refs.

19113 (LA-UR--92-759) **Possible mechanisms of macrolayer formation.** Sadasivan, P.; Chappidi, P.R.; Unal, C.; Nelson, R.A. Los Alamos National Lab., NM (United States). [1992]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9203122--1: Engineering Foundation conference on pool and external flow boiling, Santa Barbara, CA (United States), 22-27 Mar 1992). Order Number DE92011266. Source: OSTI; NTIS; GPO Dep.

The high heat flux nucleate boiling region, also called the vapor mushroom region, has been shown to have a thin liquid layer on the heater surface under the large mushroom-shaped vapor bubbles that grow from the heater surface. The name given to this liquid layer is the macrolayer to differentiate it from the microlayer that exists under the discrete bubbles found at lower heat fluxes in the nucleate boiling region. Typical thicknesses of this macrolayer range from 50 to 500 μm for water on a flat horizontal boiling surface and depend upon the heat flux. Thus, the macrolayer is thicker than the wedge-shaped microlayers, found under discrete bubbles, which range in thickness from 1 to 10 μm. Although the mechanism of microlayer formation and its evaporation is conceptually simple that of the macrolayer is still not understood. This paper critically compares the potential mechanisms proposed for macrolayer formation. These mechanisms include the Helmholtz instability applied to the vapor stem above active nucleation sites, liquid trapped by lateral coalescence of discrete bubbles that initially form during the mushroom bubble's waiting period, and the limitation of liquid resupply at mushroom departure as a result of vapor flow from the active nucleation sites.

19114 (UCRL-JC--106761) **Dissipative and fluctuating hydrodynamic interactions between suspended solid particles via lattice-gas cellular automata.** Ladd, A.J.C. Lawrence Livermore National Lab., CA (United States). Mar 1991. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9103236--1: North Atlantic Treaty Organization (NATO), Advance Study Institute (ASI) meeting, Aussois (France), 25 Mar - 5 apr 1991). Order Number DE92011408. Source: OSTI; NTIS; GPO Dep.

Lattice-gas models are simplified molecular models in which particles with a discrete set of velocities move from one node to another of a space-filling lattice, undergoing collisions with other particles occupying the same node. Macroscopic fluid dynamical behavior can be obtained by averaging over space and time. Moreover, the inherent noise in the lattice gas can be used to simulate the thermal fluctuations in a fluid which give rise to Brownian motion. A moving solid body interacts with the lattice gas via additional microrules, applied to nodes of the lattice gas coincident with the surface of the body, which represent collisions between the lattice-gas particles and the solid. These microrules are local to each node; on average they set up a hydrodynamic stick boundary condition so that the fluid next to the solid particle is moving with the local velocity of the particle surface. In this paper, I will describe how lattice gases can be used to model the dissipative and fluctuating hydrodynamic forces between solid particles in suspension.

19115 High-performance heat exchanger. Zardi, U.; Pagani, G. To Ammonia Casale SA (Switzerland). 9 Sep 1991. Filed date 9 Mar 1990. Canada Patent patent application 2011885. 15p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A high performance heat exchanger is provided for the recovery of heat from fluids such as reacted gas. The heat exchanger of the invention is characterized by a plurality of first tubes projecting from an upper tube-plate and open at the bottom. These tubes are bayonet joined to a plurality of second tubes projecting from a lower tube-plate and closed at the bottom. An airspace is located between the outer wall of the first tubes and the inner wall of the second tubes, in which heat exchange resistances are contained. These resistances are situated at least partially lengthwise along the first tubes. In a particularly advantageous preferred embodiment of the invention, these resistances are provided by inserting a third lot of tubes between the second and first tubes, the lower end of which is closed on the corresponding lower end of the third tubes. To increase heat resistance further and to avoid convection movements, means can also be provided inside the air space between the first and third tubes, more particularly by inserting insulating fluids and/or solids, or by creating vacuum zones. It has been found even more advantageous to make the heat-recovering fluid flow by forced circulation inside the bayonet tubes and the heating fluid (such as reacted gas) transferring the heat is made to flow on the shell side. 5 figs.

4205 Materials Testing

Refer also to citation(s) 18519, 18570, 18798, 18856, 18898, 18914, 18972, 18983, 19094, 19181, 19377, 20325

19116 (AECL–10461) **Nondestructive evaluation of ceramic components by γ-ray CT.** Rokugawa, S. (Nippon Kokan K.K., Kawasaki, Kanagawa (Japan). Technical Research Center); Usui, S.; Sawicka, B.D. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1991. 18p. (CONF-910572–: 5. international symposium on nondestructive characterization of materials, Karuizawa (Japan), 27-30 May 1991). Order Number DE92626843. Source: OSTI; NTIS (US Sales Only); INIS.

Results of γ-ray Computed Tomography (CT) examination of ceramic parts in various stages of the manufacturing process are presented in this paper. The ceramic samples were prepared by injection-molding and examined in three stages: before sintering and after HIPing. CT tests were performed at AECL Research, Chalk River Laboratories. The uniformity of the material distribution in ceramic parts was measured by measuring density gradients in CT images, with an accuracy of between 0.2% and 0.5% in various scans. The results demonstrate that the CT technique is very useful, particularly for monitoring changes in material distribution during various stages of the fabrication process and for providing comparisons between technologically different processes.

19117 (INIS-SU–309/A, pp. 173-184) **NIIAR research complex for core materials and elements study.** Tsykanov, V.A. (Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR)); Kuprienko, V.A.; Klochkov, E.P.; Golovanov, V.N.; Samsonov, B.V.; Seredkin, S.V.; Smirnov, V.P.; Shamardin, V.K. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The RIAR research complex has wide experimental capabilities on irradiation and investigation of materials, fuel elements and fuel assemblies and allows to acquire the necessary information on radiation materials science problems. The complex includes: reactor plants SM-2, MIR, BOR-60, RBT permitting the creation of the corresponding spectrum of neutron-physical conditions for testing the fission and fusion reactor materials; in-pile facilities for measuring the physico-mechanical properties of structural materials and fuel during irradiation; capsule and loop devices providing the appropriate temperature (80-1800 deg C) and thermohydraulic conditions of sample testing in water, vapour, sodium, gas; materials science laboratory, protection cells of which are fitted with equipment for nondestructive investigations of full-scale fuel assemlies (up to 4 m long) as well as devices for studying the materials structure and mechanical properties after irradiation. 3 refs.; 4 tabs.

19118 (LA-UR–92-958) **Automated data acquisition and analysis in the mechanical test lab.** Carter, D.H.; Gibbs, W.S. Los Alamos National Lab., NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205139–1: Symposium on automation of mechanical testing, Pittsburgh, PA (United States), 20-21 May 1992). Order Number DE92011231. Source: OSTI; NTIS; GPO Dep.

Computers and enhanced control technology have made it possible to perform more sophisticated mechanical tests than ever before, as well as to allow routine tests to be run and analyzed with much greater efficiency. Automated data acquisition, storage and analysis have become key ingredients in a mechanical test facility, especially in one which utilizes a wide variety of test equipment and techniques. This paper will discuss one such mechanical test facility where many different types of mechanical tests are performed utilizing automated data acquisition, centralized data storage and finally a complex system of automated data analysis. Various systems of data acquisition will be discussed, including those used on servohydraulic and screw- driven systems, as well as those used for higher-rate, formability and creep tests. Methods for networking equipment used in such a facility will be described. Networking is an important criterion for establishing a centralized data base, and for eventually building a system of automated data analysis.

19119 (SAND–91-1691C) **A new HyperVelocity Launcher (HVL) for space science application.** Chhabildas, L.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920373–2: American Institute of Astronautics and Aeronautics (AIAA) space programs and technologies conference, Huntsville, AL (United States), 24-27 Mar 1992). Order Number DE92010670. Source: OSTI; NTIS; GPO Dep.

Very high driving pressures (tens or hundreds of GPa), are required to accelerate flier plats to hypervelocities. This loading pressure pulse on the fiber plates must be nearly shockless to prevent the plate from melting or vaporizing. This is accomplished by using graded-density impactors referred to as "pillows." When this graded-density material is used to impact a flier-plate in a modified two-stage light gas gun, nearly shockless megabar pressures are introduced into the flier plate. The pressure pulses must also be tailored to prevent spallation of the flier-plate. This technique has been used to launch nominally 1-mm-thick aluminum, magnesium and titanium (gram-size) intact plates to 10.4 km/s, and 0.5-mm-thick aluminum and titanium (half-gram size) intact plates to 12.2 km/s. This is the highest mass-velocity capability attained with laboratory launchers to data, and should open up new regimes of impact physics and lethality studies related to space sciences for laboratory investigations. 14 refs.

19120 (SAND–92-0046) **PVDFSTRESS: A PC-based computer program to reduce Bauer PVDF stress-rate gauge data.** Wackerbarth, D.E. (Ewing Technical Design Inc., Albuquerque, NM (United States)); Anderson, M.U.; Graham, R.A. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012616. Source: OSTI; NTIS; GPO Dep.

A computer program has been developed to reduce and analyze data from a standardized piezoelectric polymer (PVDF) shock-wave stress rate gauge. The program is menu driven with versatile graphic capabilities, input/output file options, hard copy options, and unique data processing capabilities. This program was designed to analyze digital "current-mode" data recorded from a

Bauer PVDF stress-rate gauge and reduce it to a stress-versus-time record. The program was also designed to combine two simulanteously recorded data channels.

4210 Combustion Systems

Refer also to citation(s) 18000, 18784

19121 (AFME-90-11-4) **Combustion and atmospheric pollution control.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 126p. (In French). Order Number DE92792645. Source: OSTI; NTIS (US Sales Only).

The main topics of this meeting are: historic development of pollution control and abatement, The EEC politics concerning atmospheric pollution, SO2 and NOx measure and continuous monitoring at the Meudon coal heating system, SOx effluent prevention in coal heating systems (circulating fluidized bed), prediction of new SO2 and NOx regulation effects on 1980-2010 discharge trends, performances of a slab furnace lateral burner, energy recovery with a condensation exchanger on fumes from a cement kiln, energy saving and pollution reduction in fritted glaze furnaces.

19122 (CONF-9110375–, pp. 381-384) **Incineration of waste liquids and sludges in semi-circulation fluidized bed incinerators.** Yamamoto, S.; Oyama, T.; Funahara, T. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This study carried out incineration experiments on waste liquids and sludges applying circulation fluidized bed combustion technologies, for the purpose of developing a relatively small sized incinerator which can be installed in factories and other operation facilities. The direction of the development calls for an adoption of the semi-circulation type fluidized bed in which a velocity of blowing up heat media is set higher than that in the conventional bubbling type bed but lower than a circulation type bed. The incinerator comprises a fluidized bed incinerator, air preheater and cyclone for flue gas treatment. As a result of experiments, it was found that the semi-circulation fluidized bed, in which part of the heat media circulates into the free port, had small temperature difference between the free port and the fluidized bed in the lower part of the furnace, realizing a stable combustion. In addition, varying the heat media blow-up velocity enables adjusting circulation amount of the heat media, thus the temperature difference due to combustion rate of materials to be treated can be controlled between the free port section and the heat media section. 3 figs., 3 tabs.

19123 **Apparatus for combusting liquid fuel.** Skoog, K. 15 Nov 1991. Filed date 15 May 1990. Canada Patent patent application 2016855. 16p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An apparatus is provided for combusting a fluid, in particular liquid fuel such as oil. The fuel may be passed through an inlet for introduction into a combustion chamber. The fuel inlet is concentrically surrounded by an air inlet defined by coaxial inner and outer annular air ducts. The fuel inlet is formed by a plurality of injection openings disposed at approximately regular intervals along the periphery of the air inlet and discharging into the inner annular air duct. The fuel inlet, inclusive of the associated annular air ducts, is a separate unit projecting into the combustion chamber. Inside this unit, the two annular air ducts are formed by the arrangement of an intermediate tube between a central tube segment provided for fuel supply, on the one hand, and a tube segment extending coaxially with respect to the first segment and defining the air inlet radially outwardly, on the other hand. The intermediate tube is supported by spacer elements relative to both the tube segment and the central tube segment provided for fuel supply. 1 fig.

4220 Mining and Underground Engineering

19124 **Adjustable bent sub.** Wawrzynowski, M. 26 Dec 1991. Filed date 26 Jun 1990. Canada Patent patent application 2019898. 16p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An adjustable bent sub for use in earth drilling has a tubular mandrel with an offset axis which is telescopically received in a tubular housing with an offset axis. By rotation of the mandrel in relation to the housing, an adjustment may be made in a bend created by the cumulative effect of the offset axis of the mandrel and the offset axis of the housing. A longitudinal stop limits longitudinal displacement of the mandrel within the housing. The mandrel is longitudinally slidable within the housing between a first position, wherein further displacement toward the second end of the housing is limited by the longitudinal stop, and a second position, wherein the mandrel is displaced toward the first end of the housing. A rotational stop prevents relative rotation between the mandrel and the housing when the mandrel is in the first position, and allows such relative rotation when the mandrel is in the second position. A rotator acts between the mandrel and the housing, reacting to longitudinal displacement between the mandrel and the housing to cause a predetermined amount of relative rotation between the mandrel and the housing when the mandrel is displaced from the first position to the second position and returned to the first position. A split ring locks the mandrel in the first position. 3 figs.

19125 **Downhole drilling tool system.** Base, J.D.; Harvey, D. 3 Oct 1991. Filed date 3 Apr 1990. Canada Patent patent application 2013756. 47p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method is provided for receiving instructions for an implement, for example a drill string stabilizer, mounted on a drill string. The instructions are transmitted by varying the rate of flow of, or pressure exerted by, the fluid in the bore of the drill string in accordance with one of a plurality of predetermined sequences. The method of the invention consists of the following steps. Variations in the rate of flow of, or pressure exerted by, the fluid in the drill string are monitored. The sequence of monitored variations is compared with a plurality of predetermined sequences, each corresponding to a set of instructions for the implement. The variations are ignored if they do not correspond to a predetermined sequence. If the variations do correspond to a predetermined sequence, the instructions corresponding to that sequence are executed. In another aspect of the invention, a drill string stabilizer is provided, comprising a mandrel slidably mounted within an outer casing; one or more pads movable between a retracted position and one or more extended positions; means monitoring the rate of flow of, or pressure exerted by, the fluid in the drill string in use; and means which, when activated, seal the stabilizer to restrict or prevent the flow of fluid through it. The arrangement is such that, with the sealing means activated, the exertion of a predetermined amount of pressure by the fluid causes the mandrel to slide within the casing, and the pad or pads to extend in consequence. 21 figs.

4230 Marine Engineering

19126 (AUC-IBT-R--9011) **System identification of offshore platforms.** Fracture and Dynamics Paper, 22. Laigaard Jensen, J. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Apr 1990. 210p. Order Number DE92506384. Source: OSTI; NTIS (US Sales Only).

The subject of this thesis is to investigate system identification methods for determination of the dynamic characteristics of offshore platforms. This includes estimation of eigenfrequencies, damping ratios, mode shapes and, furthermore, a general assessment of the structural performance. The main purpose has been to provide a basic knowledge of system identification of structures. This has been accomplished by a survey of literature and by developing and testing different approaches on simulated as well as experimental data. (AB) 246 refs.

19127 (NEI-NO–217) **Probabilistic foundation stability analysis for gravity base structures.** Guttormsen, T.R. Oslo Univ. (Norway). 1991 340p. Order Number DE92506561. Source: OSTI; NTIS (US Sales Only).

It is desirable to adopt a more consistent approach for prediction of foundation performance of offshore gravity base structures. This is especially important where novel designs or design procedures are involved. Reliability engineering has the potential to provide the framework for rational design decisions, as uncertainties in the design parameters and the associated likelihood of adverse performance can be accounted for directly. This thesis presents probabilistic calculation techniques which are tailor-made for reliability assessment of gravity base structure foundations. An important part of the thesis is a probabilistic formulation of the Norwegian Geotechnical Institute (NGI) cyclic shear strength analysis for calculation of the bearing capacity of offshore structures subjected to combined static and cyclic loading. This calculation procedure ensures strain compatibility in the soil along the potential failure surface and accounts for the redistribution of average stresses caused by cyclic loading. The probabilistic calculation procedure includes: Determination of cyclic shear strength, iterative equilibrium calculations, and system reliability analysis to evaluate the results from the iterative equilibrium calculations. The key geotechnical item in the probabilistic formulation is the determination of the uncertainty in the cyclic shear strength of the foundation soil. The thesis presents a method to estimate this uncertainty by using simulation techniques and Latin Hypercube Sampling of the random variables which influence the uncertainty in the cyclic shear strength. 107 refs., 72 figs., 64 refs.

4250 Power Cycles

Refer also to citation(s) 18565

19128 (CONF-9001171–, pp. 87-119) **Special-purpose energy systems.** Keller, J.U. (Siegen Univ. (Germany)). Daimler-Benz AG, Berlin (Germany). Forschung Technikumfeld. Feb 1991. 125p. (In German). From Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990. In *Potential and assessment of alternative energy conversion processes. Sub-project B: Energy conversion processes - potential and assessment. Proceedings.* Order Number DE92515841. Source: OSTI; NTIS (US Sales Only).

Modern energy conversion systems for the production of electricity, heat and refrigeration are briefly discussed with regard to their thermo-physical fundamentals and their development potential. This includes: Thermo-electric alkali generators, heating fuel cells, vortex tube according to Ranque-Hilsch, power processes for fluid relief, refrigeration power processes, Vuieleumier heat pump, activated heat pipes and thermosiphons, passive solar energy utilization and waste heat power processes. (orig./UA).

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 18346, 18573, 18582, 18727, 18985, 18989, 19042, 19095, 19221, 19252, 19280, 19322, 19325, 19340, 19355, 19378, 19982, 20556, 20564

19129 (CONF-9009266–17) **The MIT Short-Wavelength Laser Project: A Status Report.** Hagelstein, P.L. (Massachusetts Inst. of Tech., Cambridge, MA (United States)); Basu, S.; Muendel, M.H.; Braud, J.P.; Tauber, D.; Kaushik, S.; Goodberlet, J.; Hung, T.Y.; Maxon, S. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1990]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From 2. international colloquium on X-ray lasers; York (United Kingdom); 17-21 Sep 1990. Order Number DE92012252. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the MIT Short-Wavelength Laser Project is to develop a small-scale, high repetition rate, EUV laser suitable for practical applications. The present report summarizes recent progress in this effort, both experimental and theoretical. Our experimental work has dealt with development of the pump laser, design of the target chamber and the associated target alignment system, investigation of short-wavelength laser cavities, and design of appropriate EUV diagnostics. Our theoretical work has included a study of the kinetics of transiently pumped laser plasmas, the development of efficient numerical algorithms applicable to laser-plasma rate equations, an investigation of frequency mixing in the EUV, and an analysis of x-ray detection using GaAs quantum-well structures.

19130 (DOE/ER/13973–5) **Nonlinear dynamics of broad-band lasers: Final report, September 15, 1990–September 14, 1991.** Raymer, M.G. Oregon Univ., Eugene, OR (United States). Dept. of Physics. Mar 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-88ER13973. Order Number DE92013493. Source: OSTI; NTIS; GPO Dep.

A number of advances were made in improving the understanding of multimode dye laser dynamics. The source of mode-intensity fluctuations in a three-mirror, multimode dye laser has been identified in the typical operating regime well above threshold. It was found experimentally that deterministic four-wave mixing interactions are the underlying cause. We have also made new theoretical studies concerning the regime just above threshold and predicted that the mode fluctuations will be dominated by quantum noise in this regime. We have constructed a short-cavity dye laser in order to enhance this quantum effect, and have made measurements of the turn-on time statistics of individual modes. Effects of coherent, four-wave mixing interactions on these statistics have been identified. 19 refs.

19131 (ENEA-RT-INN–90-43) **10 J, 100 ns pulse generator made with saturable inductors technique for x-ray sources.** Raimondi, P.; Messina, G. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione. Apr 1991. 12p. (In Italian). (RT/INN–90-43). Order Number DE92506268. Source: OSTI; NTIS (US Sales Only).

In order to generate high current and voltage (500-5000 A, 30-100 kV) and brief pulse duration (20-500 ns), saturable inductors were used instead of Thyratrons. Saturable magnetic cores and SCRs (Silicon Controlled Rectifier) performance better in case of high energy transfer. This technique is cheap, it permits shorter make times, higher repetition rates and mean life. A 80 KV, 10 J, 100 ns and 1 KHz of repetition rate pulse generator was realized. This apparatus has been tested to generate X-rays to preionize an excimer laser.

19132 (KCP–613-4667) **Large particle collection, counting and identification.** Harding, W.B. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. May 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92013705. Source: OSTI; NTIS; GPO Dep.

A detailed description of a method for collecting, identifying, and measuring large particles is presented. Design and operation of cleaning processes and the handling of product requires, among other things, the control of particulate contaminants. Fundamental to this is the ability to detect, identify, and measure particles.

19133 (KCP–613-4748) **Low thermal coefficient of expansion printed wiring boards: Final report.** Desch, J.K. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. May 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE92013704. Source: OSTI; NTIS; GPO Dep.

Production processes have been established and the reliability has been successfully proven for multilayer printed wiring boards manufactured from polyimide/quartz laminates. The polyimide/quartz is a construction of polymide resin reinforced with quartz fabric. The polymide/quartz has a lower thermal coefficient of expansion (TCE) in the X-Y plane at 9-10 ppm/°C than standard production laminates (polymide/glass and epoxy/glass) at 15–16 ppm/°C and is intended for use in conjunction with surface mount devices (SMD). The lower TCE of polymide/quartz provides a closer match to the TCE of the SMD, thereby reducing thermal stresses during temperature cycling. Surface mount technology is being used in the current programs with future applications now being considered.

19134 (LA-UR–92-754) **The Los Alamos POP Project: FEL oscillator experiments in the ultraviolet and beyond.** Newnam, B.E.; Warren, R.W.; Goldstein, J.C.; Schmitt, M.J.; Bender, S.C.; Carlsten, B.E.; Feldman, D.W.; O'Shea, P.G. Los Alamos National Lab., NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9108118–48: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92011286. Source: OSTI; NTIS; INIS; GPO Dep.

The Los Alamos POP Project will include a series of proof-of-principle FEL oscillator experiments in 1992 designed to extend FEL operation into the ultraviolet (UV) and vacuum ultraviolet (VUV). With beam energy extended to 50 MeV, enhanced beam brightness with a photoinjector, and appropriate UV and VUV resonator optics, the Los Alamos FEL oscillator should have sufficient single-pass gain (20–30%) to reach below 200 nm. The first goal will be lasing at 250 nm utilizing a permanent-magnet undulator with 5-mm period or alternatively on the third harmonic with a 1-cm period. To operate at VUV wavelengths of 200 and 150 nm (third harmonic), pulsed electromagnetic microwigglers with periods of 5.7- and 4.3 mm will be employed. 23 refs.

19135 (LA-UR–92-896) **VUV production from a ferrite-driven flash-pumped system.** Sze, R.C. (Los Alamos National Lab., NM (United States)); Sentis, M. Los Alamos National Lab., NM (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-911296–6: Lasers '91, San Diego, CA (United States), 8-13 Dec 1991). Order Number DE92011362. Source: OSTI; NTIS; GPO Dep.

The relative spectral emission as a function of wavelength in the 1200–2900 Å region is measured for a vacuum UV flash device whose discharge is initiated by a high resistance formed-ferrite rod. The device is studied because of its usefulness in the optical pumping of large volume laser systems.

19136 (PPPL–2835) **A microsphere-based short-wavelength recombination x-ray laser.** Valeo, E.J.; Cowley, S.C. Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013244. Source: OSTI; NTIS; INIS; GPO Dep.

We describe a scheme for obtaining very short wavelengths ($\lambda \sim 10$Å) in recombination lasers. The rapid cooling rates necessary to achieve population inversion during recombination are attained by adiabatic expansion of sub micron spheres. The lasing region is made up of many such spheres. The spheres are heated impulsively by a powerful picosecond laser. First, they ionize, then as they expand, they cool and recombine. We have calculated the optimum sphere size and initial temperature for maximum gain in the $n = 3$ to $n = 2$ transition of hydrogen-like ions of elements with atomic numbers, Z, between 10 and 30. Gain of about $10^3 \mathrm{cm}^{-1}$ is calculated in aluminum at 38.8Å. Gain rapidly decreases with Z so that gain in titanium at 13.6Å is about 40 cm−1. We have calculated the required pump laser intensity and found it to be attainable with current lasers. The propagation of the pump through the "gas" of spheres is considered and the problems arising from pump scattering by the spheres are discussed.

19137 (SAND–91-2807) **User's manual for the pressure controller in the Transducer Calibration Laboratory.** Leisher, W.B. (Sandia National Labs., Albuquerque, NM (United States)); Sanchez, D.A. Sandia National Labs., Albuquerque, NM (United States). May 1992. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013781. Source: OSTI; NTIS; GPO Dep.

This manual is intended to aid operators of the pressure controller in the Transducer Calibration Laboratory. We include discussions of automated control, data acquisition, and data analysis techniques that improve the quality and thoroughness of transducer pressure calibration procedures.

19138 (SAND–92-0211) **A ban on use of lead-bearing solders: implications for the electronics industry.** Vianco, P.T.; Yost, F.G. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013291. Source: OSTI; NTIS; GPO Dep.

This white paper addresses the issue of banning lead from solders used in electronics manufacturing. The current efforts by legislative bodies and regulatory agencies to curtail the use of lead in manufactured goods, including solders, are described. In response to a ban on lead or the imposition of a tax which makes lead uneconomical for use in solder alloys, alternative technologies including lead-free solders and conductive epoxies are presented. The recommendation is made that both users and producers of solder materials join together as partners in a consortium to address this issue in a timely and cost-effective manner.

19139 (SAND–92-0271C) **Stress analysis of plated-through-holes in rigid flex multilayer printed wiring boards.** Burchett, S.N. Sandia National Labs., Albuquerque, NM (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204115–1: 35. Institute for Interconnecting and Packaging Electronic Circuits (IPC) annual meeting, Bel Harbor, FL (United States), 5-10 Apr 1992). Order Number DE92011659. Source: OSTI; NTIS; GPO Dep.

A rigid/flex printed wiring board is a hybridized system of wiring interconnects utilizing the concepts of both multilayer and flexible circuit technology. This type of printed wiring board offers significant advantages in the production of complex electronic assemblies. In contrast to standard printed wiring board assemblies which are homogeneous in material composition, rigid/flex assemblies have a combination of different laminates, films, and adhesives arranged to accomplish the electrical and mechanical design goals. After lamination, the circuit layers are interconnected using plated-through-hole technology. Associated with the plated-through-holes are at least two observed failure modes, barrel cracks and inner layer foil cracks, that develop during thermal testing of completed printed wiring board assemblies. Due to these failures, there is concern about the reliability of such systems. This paper presents the results from finite element stress analyses employed to assist in the understanding of failure modes in a plated-through-hole of a rigid/flex multilayer printed wiring board. The results of the analyses provided substantial insight about the thermal-structural response of the assembly and provided guidance to process improvements aimed at eliminating the failures. 6 refs.

19140 (SAND–92-0377C) **Interface-trap buildup and hydrogen incorporation in MOS oxides.** Shaneyfelt, M.R. (Sandia National Labs., Albuquerque, NM (United States)); Schwank, J.R.; Fleetwood, D.M.; Winokur, P.S.; Hash, G.L.; Hughes, K.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920716–2: Nuclear and space radiation effects conference, New Orleans, LA (United States), 13-17 Jul 1992). Order Number DE92008328. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Qualitatively different time dependencies are observed for interface-trap buildup in dry- and wet-gate oxides with thickness ranging from ~20 nm to ~100 nm. These results suggest that hydrogen is incorporated differently in the oxides.

19141 (SAND–92-0448) **Analysis of a digital RF memory in a signal-delay application.** Jelinek, D.A. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013457. Source: OSTI; NTIS; GPO Dep.

Laboratory simulation of the approach of a radar fuze towards a target is an important factor in our ability to accurately measure the radar's performance. This simulation is achieved, in part, by dynamically delaying and attenuating the radar's transmitted pulse and sending the result back to the radar's receiver. Historically, the device used to perform the dynamic delay has been a limiting factor in the evaluation of a radar's performance and characteristics. A new device has been proposed that appears to have more capability than previous dynamic delay devices. This device is the digital RF memory. This report presents the results of an analysis of a digital RF memory used in a signal-delay application. 2 refs.

19142 (SAND–92-0736C) **Testing of Double-Layer Capacitors for high reliability applications.** Clark, N.H. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920669–4: 35. international power sources symposium, Cherry Hill, NJ (United States), 22-25 Jun 1992). Order Number DE92011384. Source: OSTI; NTIS; GPO Dep.

Double Layer Capacitors (DLCs) have been used mainly for computer memory backup in consumer products during the last ten years. Their high capacitance density along with maintenance-free operation makes them suited for these applications. In recent years users, mostly military customers, have expressed interest in using them in high reliability applications both for backup power and pulse power applications. To meet this need developers have pursued technologies that use carbon and mixed metal oxides as the electrode material to produce high reliability Double-Layer Capacitors. In this paper, the carbon based DLCs were manufactured by Evans Co. and the Mixed Metal Oxides (MMO) DLCs by Pinnacle Research Inc. There are few published data on their reliability in adverse environments. This paper demonstrates their environmental stability in temperature, shock, vibration and linear acceleration. The purpose of this paper is to review the available test data for both types of DLCs under these stress conditions. The data for this paper was generated by Sandia National Laboratories, General Electric Neutron Devices Division, Motorola Company and Evans Company.

19143 (SAND–92-0816C) **Adaptive inverse filter.** Kalb, J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205141–1: Ideas in science and electronics symposium, Albuquerque, NM (United States), 14 May 1992). Order Number DE92011660. Source: OSTI; NTIS; GPO Dep.

This paper describes the design of an inverse adaptive filter, using the Least-Mean-Square (LMS) algorithm, the correct data taken with an analog filter. The gradient estimate used in the LMS algorithm is based upon the instantaneous error, $e^2(n)$. Minimizing the mean-squared-error does not provide an optimal solution in this specific case. Therefore, another performance criterion, error power, was developed to calculate the optimal inverse model. Despite using a different performance criterion, the inverse filter converges rapidly and gives a small mean-squared-error. Computer simulations of this filter are also shown in this paper.

19144 (UCRL–21203-Vol.3) **[Theoretical studies and algorithm development for x-ray lasers]: Progress report, December 1, 1989–September 30, 1990: Volume 3.** Hagelstein, P. (Massachusetts Inst. of Tech., Cambridge, MA (United States). Research Lab. of Electronics); Basu, S.; Kaushik, S.; Goodberlet, J. Lawrence Livermore National Lab., CA (United States); Massachusetts Inst. of Tech., Cambridge, MA (United States). Research Lab. of Electronics. [1990]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011442. Source: OSTI; NTIS; INIS; GPO Dep.

We report on our progress in the use of conjugate gradient algorithms in the solution of NLTE rate equations, theoretical and experimental progress on the quantum well x-ray detector project, and documentation of the QED numerical effort.

19145 (UCRL-ID–110194) **A coordinated US program in soft x-ray projection lithography.** Ceglio, N.M. Lawrence Livermore National Lab., CA (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012397. Source: OSTI; NTIS; GPO Dep.

This report discusses soft x-ray projection lithography (SXPL), technical development requirements, technological capabilities in the US SXPL community; and a coordinated technical program in SXPL. (LSP).

19146 (UCRL-JC–103782-Rev.1) **Subnanosecond photoconductive switching in GaAs.** Druce, R.L.; Pocha, M.D.; Griffin, K.L. Lawrence Livermore National Lab., CA (United States). Apr 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-900397–3-Rev.1: 1. Los Alamos symposium on ultra-wideband radar, Los Alamos, NM (United States), 5-8 Mar 1990). Order Number DE92011521. Source: OSTI; NTIS; GPO Dep.

We are conducting research in photoconductive switching for the purpose of generating microwave pulses with amplitudes up to 50 kV. This technology has direct application to impulse radar and HPM sources. We are exploiting the very fast recombination rates of Gallium Arsenide (GaAs) to explore the potential of GaAs as an on-off switch when operating in the linear mode (the linear mode is defined such that one carrier pair is generated for each photon absorbed). In addition, we are exploring the potential GaAs to act as a closing switch in "avalanche" mode at high fields. We have observed switch closing times of less than 200 psec with a 100 psec duration laser pulse and opening times of less than 400 psec with neutron irradiated GaAs at fields of tens of kV/cm. If the field is increased and the laser energy decreased, the laser can be used to trigger photoconductive switches into "avalanche" mode of operation in which carrier multiplication occurs. This mode of operation is quite promising since the switches close in less than 1 nsec while realizing significant energy gain (ratio of electrical energy in the pulse to optical trigger energy). We are currently investigating both large area (1 sq cm) and small area (< 1 sq mm) switches illuminated by GaAlAs laser diodes at 900 nm and Nd:YAG lasers at 1.06 micrometers. Preliminary results indicate that the closing time of the avalanche switches depends primarily on the material properties of the devices with closing times of 300–1300 psec at voltages of 6–35 kV. We will present experimental results for linear, lock on and avalanche mode operation of GaAs photoconductive switches and how these pulses may be applied to microwave generation. 3 refs.

19147 (UCRL-JC–107745) **The x-ray laser coherence experiments in neon-like yttrium.** Shimkaveg, G.M.; Carter, M.R.; Walling, R.S.; Ticehurst, J.M.; Koch, J.A.; Mrowka, S.; Trebes, J.E.; MacGowan, B.J.; Da Silva, L.B.; Matthews, D.L.; London, R.A.; Stewart, R.E. Lawrence Livermore National Lab., CA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911296–5: Lasers '91, San Diego, CA (United States), 8-13 Dec 1991). Order Number DE92010714. Source: OSTI; NTIS; INIS; GPO Dep.

We present recent results from neon-like x-ray laser experiments conducted at the Nova laser's Two-Beam Facility. This begins a series of experiments aimed at the characterization and control of the degree of spatial coherece in our soft x-ray laser beams, important to planned applications areas susch as microscopy and holography. New instrumentation developed for this effort include a fully time-resolved coherence diagnostic (which records a multiple-slit diffraction pattern) and wide-angle extreme ultraviolet spectrographs and beam divergence cameras. We present new measurements of beam profiles and gain, as well as spatial coherence data such as time-resolved multi-slit diffraction patterns. This new time-resolved coherence data exhibit aperture functions which increase in size during the time of the lasing. Also, some preliminary data is given from the first "double-foil" experiments, involving two x-ray amplifiers spatially separated by 29 cm and shot sequentially, in an "oscillator-amplifier" configuration.

19148 (UCRL-JC–108127) **X-ray laser research at the Nova laser.** MacGowan, B.J. Lawrence Livermore National Lab., CA (United States). 8 Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920124–24: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92012695. Source: OSTI; NTIS; GPO Dep.

Laboratory x-ray lasers are currently being studied by researchers by LLNL using the Nova glass laser as a pump source. Laser action has been demonstrated at wavelengths as short as 35.6 Å while x-ray amplifier saturation has been observed with longer wavelength schemes. The most successful schemes to data have been collisionally pumped x-ray lasers which use the thermal electron distribution within a laser produced plasma to excite electrons from closed shells in neon- and nickel-like ions to higher energy metastable levels. The multitude of x-ray laser wavelengths produced by isoelectronic scaling of these laser schemes results in a quasi-tunable bright source of x-rays that presently spans the range 35–300 Å, (40 to 350 eV). Currently attempts are being made to quantify and improve the longitudinal and transverse coherence of collisionally pumped x-ray lasers in order to increase their usefulness for specific applications.

19149 (UCRL-JC–108146) **High performance of copper pumped dye lasers.** Hackel, R.P. Lawrence Livermore National Lab., CA (United States). 1 Feb 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911296–9: Lasers '91, San Diego, CA (United States), 8-13 Dec 1991). Order Number DE92011763. Source: OSTI; NTIS; INIS; GPO Dep.

Narrowband, spectrally formatted and near diffraction limited light from dye master-oscillator-power amplifier chains pumped by copper lasers support several missions including Atomic Vapor Laser Isotope Separation, laser guide star experiments and laser materials processing studies.

19150 (UCRL-JC–109389) **Large-area sol-gel multilayer laser reflectors applied by meniscus coating.** Britten, J.A.; Thomas, I.M. Lawrence Livermore National Lab., CA (United States). 19 Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920310–8: American Institute of Chemical Engineers spring meeting, New Orleans, LA (United States), 29 Mar - 2 apr 1992). Order Number DE92011849. Source: OSTI; NTIS; GPO Dep.

A meniscus coating method to produce multilayer laser reflectors on 30+ cm substrates is described. These high-laser damage threshold (LDT) dielectric coatings are deposited from colloidal suspensions of silica and alumina nanometer-scale particles. The deposition process involves forcing a slow suspension flow through a porous applicator tube, forming a falling film on the tube. A substrate contacts this film to form a meniscus, and then moves relative to the applicator to entrain a film upon itself, which thins to optical dimensions upon solvent evaporation. The fluid dynamics of meniscus coating are briefly described, and optically measured dried film thicknesses are compared to theoretical predictions. Deviations from the theory are traced to non-Newtonian rheology of one of the suspensions used. Preliminary multilayer coating results which focus on large-scale uniformity and LDT are presented.

19151 (UCRL-JC–110158) **Active modelocking and phase stabilization of a cavity dumped diode pumped Nd:YAG mini-laser.** Ruggiero, A.J. Lawrence Livermore National Lab., CA (United States). Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920573–7: CLEO/QELS '92, Anaheim, CA (United States), 10-17 May 1992). Order Number DE92011946. Source: OSTI; NTIS; GPO Dep.

The design and operation of a variable repetition rate, acousto-optically cavity dumped, actively modelocked and phase stabilized diode pumped Nd:YAG mini-laser is reported. Use of a piezoelectrically induced strain optic (PESO) loss modulator for modelocking results in stable 20psec pulses at 1064nm over a range of repetition rates from single shot to the 100MHz oscillator frequency.

19152 (VTT-TIED–1167) **Computer aided failure mode and effect analysis.** Lehtelae, M. (Technical Research Centre of Finland, Espoo (Finland). Safety Engineering Lab.); Kuhakoski, K. Technical Research Centre of Finland, Espoo (Finland). Sep 1990. 37p. (In Finnish). Order Number DE92506485. Source: OSTI; NTIS (US Sales Only).

The aim of this study was to create a program with which the failure mode and effect analysis (FMEA) of analog electronic circuits can be made as automatically as possible. The study of computer aided FMEA was based on the fact that there is no suitable program for this purpose in the market, and that the manual performance of FMEA is usually arduous. This report includes information about the structure, memory control, interface and other characteristics of the program as well as the theoretical methods used in programming. The FMEA, the characteristics, and use of the program in general are illustrated also by examples. Finally, the program and the future needs of developing it are evaluated. The analog circuits that include the most usual electronic components can be evaluated in their normal and failure form at DC, AC or transient level. The FMEA can be performed automatically or interactively, and the program always gives the node voltages as a result of the simulation. The selection of components and analyses in this program is not as versatile as in many commercial circuit simulation programs, but on the other hand, the structure of the program makes it possible to extend the characteristics for future requirements.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 20564

19153 (AECL–10337) **Progress report - physical sciences TASCC division 1990 July 01 - December 31.** Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. May 1991. 142p. (PR-TASCC–1.). Order Number DE92626802. Source: OSTI; NTIS (US Sales Only); INIS.

A completely new administrative structure of AECL Research was implemented on 1990 July 1. All of the basic physics programs, together with accelerator physics, radiation applications and most of the chemistry programs of AECL, have been placed in a new organizational unit called Physical Sciences. This unit also includes the management of the National Fusion Program. The research programs of Physical Sciences are grouped into three divisions: Chemistry, Physics and TASCC. Progress in each division will henceforth be reported on a twice-yearly basis. This report is the first of the new series to be issued by the TASCC Division. During the period covered by this report, the operation of the superconducting cyclotron has matured considerably, with over 30 accelerated ion beams more-or-less routinely available for a wide variety of nuclear physics experiments. The TASCC team, together with all the engineers, trades-people and other staff members who contributed to the design, constructed and commissioning of the Tandem Accelerator Superconducting Cyclotron facility, are to be heartily congratulated on bringing it to its present highly successful state in an unusually short period of time. In conjunction with our many outside collaborators, we are now engaged on exciting experiments in several areas of nuclear physics research, as reported in the following pages. We are well on the way to the establishment of a truly National Centre for Nuclear Physics research in Canada.

19154 (AECL–10431) **Progress report - physical sciences TASCC division 1991 January 01 - June 30.** Hardy, J.C. (ed.). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1991. 104p. (PR-TASCC–2.). Order Number DE92626803. Source: OSTI; NTIS (US Sales Only); INIS.

This is the second in a new series of reports of the work of the TASCC Division since the creation of the Physical Sciences Unit in 1990. Physical Sciences comprises four main sectors, namely the TASCC, Physics and Chemistry Divisions, and the National Fusion Program Management Office. Physics Division is responsible for research and development in the areas of condensed matter physics, neutron and neutrino physics, and accelerator physics, while TASCC Division deals with research performed with the Tandem and Superconducting Cyclotron accelerators, primarily in the field of Heavy Ion Nuclear Physics.

19155 (DOE/EH–0226P) **Organizational cultural survey of the Stanford Linear Accelerator Center.** USDOE, Washington, DC (United States). Nov 1991. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012436. Source: OSTI; NTIS; GPO Dep.

At the request of the Department of Energy, an Organizational Survey (OS) was administered at the Stanford Accelerator Center (SLAC). The OS measured employees' opinions on subjects such as organizational culture, communication, commitment, group cohesion, coordination, safety, environmental issues, and job satisfaction. The result of this work was a quantitative measure of the notion of culture at the SLAC site. This report presents these results and discusses their interpretation.

19156 (JINR-D–9-89-52(v.2)) **Proceedings of 11. All-Union conference on charged particles accelerators. V. 2.** Vasil'ev, A.A. AN SSSR, Moscow (USSR). Fizicheskij Inst.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). 1989.

459p. (CONF-8810289–: 11. All-Union conference on charged particle accelerators, Dubna (USSR), 25-27 Oct 1988). Order Number DE92001343. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers in these proceedings are indexed.

19157 (RAL–89-050) **ISIS annual report for the financial year 1 April 1988 to 31 March 1989.** Rutherford Appleton Lab., Chilton (United Kingdom). Jul 1989. 301p. Order Number DE92626804. Source: OSTI; NTIS (US Sales Only); INIS.

Over the past year, to 31st March 1989, ISIS has not only maintained its position as the world's most powerful pulsed neutron - and muon -source, but has made further notable strides forward. The operating current has increased, reliability has improved significantly, new instruments have come into operation, and new science has underlined yet again the major advantages of pulsed spallation sources. A new management structure was put in place during the year, and several bilateral agreements were finalised. (author).

19158 (RAL–90-050) **ISIS annual report for the financial year 1 April 1989 to 31 March 1990.** Rutherford Appleton Lab., Chilton (United Kingdom). Jul 1990. 380p. Order Number DE92626805. Source: OSTI; NTIS (US Sales Only); INIS.

The year 1989/1990 has been another year of significant achievements at the ISIS Facility at Rutherford Appleton Laboratory - still the world's most powerful pulsed neutron and muon source. New records of current and reliability have been established by the accelerator and the instrument suite continues to expand. Demand for both neutron and muon time remains high and the quality and breadth of the scientific programme is evident in this, our fifth, Annual Report. The accelerator continues to improve, with proton currents in excess of 100 μA averaged over a week and the daily average record now standing at 107 μA. A significant injection of funds will come through Germany's KfK to enhance the performance of the accelerator over a three year period. This will lead to improvements in reliability and current which will benefit all users of the Facility. A major advance this year has been the commissioning of two new instruments - the joint United Kingdom-Japanese spectrometer MARI and the liquids diffractometer SANDALS. (author).

4301 Design, Development, and Operation

Refer also to citation(s) 18131, 19202, 19467, 20353, 20452, 20484

19159 (ANL/APS/IN/VIB–89/1) **Dynamic analysis of the 7-GeV APS experiment hall foundation based on equivalent lumped parameter modeling.** Wambsganss, M.W. Argonne National Lab., IL (United States). 25 Jan 1989. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012175. Source: OSTI; NTIS; INIS; GPO Dep.

In this technical note, mass-spring-dashpot, also referred to as equivalent lumped parameter, models are employed to model the soil-foundation interaction of two typical floor segments from the 7-GeV APS experiment hall. Equivalent lumped parameter models have the advantage of being easy to apply and of readily allowing for parameter studies. Analysis requires knowledge of certain properties of the soil including density, shear wave velocity, and Poisson's ratio, as well as knowledge of the degree of homogeneity of the underlying soil stratum. These data for the APS site were determined by a geotechnical investigation. A soil profile and pertinent data, obtained from crosshole seismic testing, are given. Natural frequencies and damping are calculated for the vertical, sliding, rocking, and coupled rocking/sliding modes of vibration. Subsequently, various corrections to account for modeling "deficiencies" are considered and their influences evaluated. The equivalent lumped parameter models were developed for machine foundations which, compared with the APS foundation, are smaller in plan dimension. Therefore, the applicability of these models in the analysis of the dynamic characteristics of the APS foundation must be established. The modeling is evaluated by applying the equivalent lumped parameter models in the analysis of large foundations for which test data exists. A comparison of theoretical and test results establishes the basis for an assessment of the applicability and accuracy of the modeling.

19160 (ANL/APS/IN/VIB–90/1) **Surveillance of 18 Hz and 60 Hz components of ground motion at the APS site.** Jendrzejczyk, J.A.; Wambsganss, M.W.; Smith, R.K. Argonne National Lab., IL (United States). 1 Mar 1990. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012173. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this study are to determine the location and source of the 18- and 60-Hz vibration and to eliminate or reduce its amplitude in the APS Facility. To accomplish this it is necessary to know the time of occurrence and then, to utilize triangulation methods to identify the location of the source. It its time sequence is known, it may be possible to correlate it with the operation of some equipment at or near the site. Therefore, a major effort was made to obtain the time sequence and is the basis of this note.

19161 (CONF-9105202–, pp. 6, Paper 1) **Supercomputing activities at the SSC Laboratory, the main collider and the HEB.** Yiton Yan (Superconducting Super Collider Lab., Dallas, TX (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Supercomputers are used to simulate and track particle motion around the collider rings and the associated energy boosters of the Superconducting Super Collider (SSC). These numerical studies will aid in determining the best design for the SSC. There are many other supercomputing activities at the SSC Laboratory, including studies of magnet design, cryogenics, and detector. Each component of the SSC complex must be designed properly to ensure successful operation. Since all of these designs involve a high degree on nonlinearity in mathematical formulation, numerical calculations are required. Actually, large-scale computer simulations are probably the only way to obtain a detailed understanding of each component of the SSC.

19162 (CONF-9105202–, pp. 8, Paper 11) **Applications of large-scale computation to particle accelerators.** Herrmannsfeldt, W.B. (Stanford Linear Accelerator Center, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC03-76SF00515. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

The rapid growth in the power of large-scale computers has had a revolutionary effect on the study of charged-particle accelerators that is similar to the impact of smaller computers on everyday life. Before an accelerator is built, it is now the absolute rule to simulate every component and subsystem by computer to establish modes of operation and tolerances. The authors will bypass the important and fruitful areas of control and operation, and consider only application to design and diagnostic interpretation. Applications of computers can be divided into separate categories including: (1) component design; (2) system design; (3) stability studies: (4) cost optimization: (5) operating condition simulation. For the purposes of this report, he will choose a few examples from the above categories to illustrate the methods used, and discuss the significance of the work to the project. He also briefly discusses the accelerator project itself. The examples that will be discussed are: The design of accelerator structures for electron-positron linear colliders and circular colliding beam systems (B-factories). Simulation of the wake fields from multibunch electron beams for linear colliders. Particle-in-cell simulation of space-charge dominated beams for an experimental linear induction accelerator for Heavy Ion Fusion.

19163 (INIS-mf–13179, pp. 139-153) **Accelerator programme at CAT.** Ramamurthi, S.S. (Centre for Advanced Technology, Indore (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol.*

33A (1990). Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The Accelerator Programme at the Centre for Advanced Technology (CAT), Indore, has very broad based concept under which all types of accelerators are to be taken up for design and fabrication. This centre will be housing a wide variety of accelerators to serve as a common facility for the universities, national laboratories in addition to laboratories under the Department of Atomic Energy. In the first phase of the programme, a series of electron accelerators are designed and fabricated. They are synchrotron radiation sources of 450 MeV (INDUS-I) and of 2 GeV (INDUS-II), microtron upto energy of 20 MeV, linear accelerator upto 20 MeV, and DC Accelerator for industrial irradiation upto 750 KeV and 20 KW. A proton accelerator of 300 MeV with 20 MeV linac injector is also designed. CAT is also developing a strong base for support technologies like ultra high vacuum, radio frequency and microwaves, DC pulsed and superconducting magnets, power supplies and controls etc. These technologies are very useful for other industrial applications also. To develop user groups to utilise INDUS-II synchrotron radiation source, a batch production of rotating Anode X-ray generators with power supplies has been initiated. So also, the sputter ion pumps, electron guns, turbo molecular pumps are brought into batch production. (author).

19164 (INP–1466/PS, pp. 69-71) **The COSY - Juelich project - Feb. 1989 status.** Maier, R. (Forschungszentrum Juelich GmbH (Germany)); Martin, S.; Pfister, U. Institute of Nuclear Physics, Cracow (Poland); Uniwersytet Jagiellonski, Cracow (Poland). Inst. Fizyki. 1989. (CONF-8904247–: 24. Zakopane school on physics, Zakopane (Poland), 16-30 Apr 1989). In *Proceedings of 24. Zakopane school on physics, Zakopane, Poland, 16-30 April 1989. Part 1.: Selected topics in nuclear structure: Part 1. Selected topics in nuclear structure.* 364p. Order Number DE92622580. Source: OSTI; NTIS (US Sales Only); INIS.

The layout of COSY the cooler synchrotron and storage ring at Juelich is presented. Together with the most important design considerations an overview of the actual scheme and realization status is discussed. Details on the upgrading of the injector cyclotron, the injection and the extraction beamlines are given. The machine and beam parameters are shown. (author).

19165 (INS-T–505) **The design of the new control program (CSA90) for the TARN2.** Aoki, Kenichi (Sumitomo Heavy Industries Ltd., Tokyo (Japan)); Watanabe, Shinichi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Oct 1991. 29p. (In Japanese). Order Number DE92514941. Source: OSTI; NTIS (US Sales Only); INIS.

The control program CSA90 for new control system of TARN2 is designed. In this control system, the separate units execute the man-machine communications and device control. The EXU executes the devices control, whereas OPU's or LGU's execute the man-machine communications. These units are connected via an Ethernet. The CSA90 provides a flexible and expandable control system to us. This program has a basic program, device control programs, configuration definition files and a data generator. The device control programs are a set of subroutines and they have no direct relation to each other. The basic program executes those subroutines according to a configuration program and a request from the OPU. To make the configuration file easily, a data generation program is also provided. By using CSA90, supplements of new functions or modification of the control procedures are easily made by addition or modification of the subroutines. Then the control sequence or configuration of the control system could be changed easily in according to the purpose of accelerator study and so on. In this paper, the idea and structure of the control program, CSA90, for the EXU are described. (author).

19166 (JINR–9-90-152) **JINR synchrotron. Performance and improvement (quarter 1 and 2, 1989).** Balandikov, A.N. (and others); Voevodin, M.A.; Volkov, V.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 5p. (In Russian). Order Number DE92626808. Source: OSTI; NTIS (US Sales Only); INIS.

A report on the JINR synchrotron performance in the first and second quarter of 1989 and on accomplished scientific scientific program is presented. A description of a new magnet channel on the second route on the slow beam extraction (SE-2) of nuclei with the energy up to 2.6 GeV/c is given. A scheme of establishment of local computer network of the accelerator complex and the parameters of the utilized computers are presented.

19167 (KINR–90-24) **Main parameters of the accelerator - storage ring at the Institute of Nuclear Research Ukrainian Academy of Sciences: Kiev, project.** Dolinsky, A.V.; Papash, A.I.; Pavlov, S.N.; Rudchik, A.T.; Valkov, A.E.; Vishnevsky, I.N.; Zhmendak, A.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 6p. Order Number DE92626809. Source: OSTI; NTIS (US Sales Only); INIS.

The main parameters of the accelerator-storage ring and electron beam system using for cooling of the heavy ions, are described. Cyclotron U-240 serves as an injector in the ring. Parameters of injecting beam of U-240 are given. 1 refs.; 1 tab.

19168 (LBL–31243) **The Advanced Light Source at Lawrence Berkeley Laboratory.** Robinson, A.L.; Perera, R.C.C.; Schlachter, A.S. Lawrence Berkeley Lab., CA (United States). Oct 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-910730–30: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92011728. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS) at the Lawrence Berkeley Laboratory (LBL), scheduled to be operational in the spring of 1993 as a US Department of Energy national user facility, will be a next-generation source of soft x-ray and ultraviolet (XUV) synchrotron radiation. Undulators will provide the world's brightest synchrotron radiation at photon energies from below 10 eV to above 2 keV; wiggler and bend-magnet radiation will extend the spectral coverage with high fluxes above 10 keV. These capabilities will support an extensive research program in a broad spectrum of scientific and technological areas in which XUV radiation is used to study and manipulate matter in all its varied gaseous, liquid, and solid forms. The ALS will also serve those interested in developing the fabrication technology for micro- and nanostructures, as well as characterizing them.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 19161, 19162, 19201, 19218, 19262, 20261

19169 (AECL–10364) **Useful forms of the Hamiltonian for ion-optical systems.** Davies, W.G. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Apr 1991. 21p. Order Number DE92626812. Source: OSTI; NTIS (US Sales Only); INIS.

The symbiosis of differential algebra and the Lie-algebraic formulation of optics provides a set of very powerful tools for analyzing and understanding the orbit dynamics of complex accelerators up to very high orders. In order to use these tools effectively it is usually necessary to express the Hamiltonian in the appropriate coordinate system. In this report, the relativistic Hamiltonian is derived in curvilinear (the fundamental coordinate system for ion-optics), Cartesian and polar coordinates, in forms suitable for solving problems in ion optics and accelerator physics both with and without the help of differential algebra.

19170 (BNL–46678) **Conversion of power and frequency.** Ruggiero, A.G.; Wei, J. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920315–33: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012543. Source: OSTI; NTIS; INIS; GPO Dep.

This paper deals with a novel idea to excite electrons to radiate energy in the short (millimeter) wavelength range. A short electron bunch is made to travel along the axis of a waveguide where a TM electromagnetic wave is also traveling and causes the beam to perform transverse oscillations. The electrons radiate energy as a consequence of the oscillations. It is found that a convenient mode of operation is to drive the waveguide in proximity of the cut-off.

19171 (BNL–46683) **Transition crossing in the RHIC.** Wei, Jie. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920315–30: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92013031. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the study of various longitudinal problems pertaining to the transition-energy crossing in the proposed Relativistic Heavy Ion Collider. Scaling laws are provided for the effects of chromatic non-linearity, self-field mismatch, and microwave instability. It is indicated that the beam loss and bunch-area growth are mainly caused by the chromatic non-linear effort, which is enhanced by the space-charge force near transition. Computer simulation using the program. TIBETAN shows that a "γT-jump" of about 0.8 unit within a time period of 60 ms is adequate to achieve a "clean" crossing, provided that the remnant voltage of the 160 MHz rf system is less than 10 kV.

19172 (BNL–46684) **Stochastic cooling with a double rf system.** Wei, Jie. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920315–29: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92013032. Source: OSTI; NTIS; INIS; GPO Dep.

Stochastic cooling for a bunched beam of hadrons stored in an accelerator with a double rf system of two different frequencies has been investigated. The double rf system broadens the spread in synchrotron-oscillation frequency of the particles when they mostly oscillate near the center of the rf bucket. Compared with the ease of a single rf system, the reduction rates of the bunch dimensions are significantly increased. When the rf voltage is raised, the reduction rate, instead of decreasing linearly, now is independent of the ratio of the bunch area to the bucket area. On the other hand, the spread in synchrotron-oscillation frequency becomes small with the double rf system, if the longitudinal oscillation amplitudes of the particles are comparable to the dimension of the rf bucket. Consequently, stochastic cooling is less effective when the bunch area is close to the bucket area.

19173 (BNL–46685) **Theory of the tune shift due to linear coupling.** Parzen, G. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920407–2: 3. European particle accelerator conference, Berlin (Germany), 7-11 Apr 1992). Order Number DE92013033. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents analytical perturbation theory results for ν_1, ν_2, the tune in tune presence of linear coupling.

19174 (BNL–46686) **Theory of the beta function shift due to linear coupling.** Parzen, G. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920407–1: 3. European particle accelerator conference, Berlin (Germany), 7-11 Apr 1992). Order Number DE92013034. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents analytical perturbation theory results for β_1, β_2, the beta functions in the presence of linear coupling.

19175 (BNL–46687) **Study on a longitudinal damper system.** Xu, Jianming. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920315–21: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012209. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. BEAM DYNAMICS/damping; BEAM EMITTANCE; ERRORS; BEAM INJECTION; BEAM BUNCHING; KICKER MAGNETS; BROOKHAVEN RHIC; GOLD IONS; INSTABILITY; DAMPING

19176 (BNL–47378) **Longitudinal bunch profile measurements with striplines.** Kramer, S.L. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920315–28: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92013035. Source: OSTI; NTIS; INIS; GPO Dep.

Striplines beam position monitors are normally considered low frequency devices with at best an octave bandwidth. Some attempts to make them very high frequency and broadband have led to long and complicated tapered construction. However, conventional uniform coupling striplines can provide very high frequency and broadband response, if the downstream induced signal is gated out electronically. In this case, the leading edge beam signal can provide bunch length and even current profile information for bunch lengths shorter than the length of the stripline. Recent improvement in transient digitizers have made these measurements possible for accelerator operations. Measurements of bunch lengths down to 50 psec are results are presented. Improvements to striplines and measurement systems are discussed, that could lead to bunch length resolutions $\approx$ 10 psec.

19177 (DOE/ER/40625–T1) **Dissemination and support of ARGUS for accelerator applications: Technical progress report, April 24, 1991–January 20, 1992.** Science Applications International Corp., McLean, VA (United States). 20 Jan 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91ER40625. Order Number DE92013726. Source: OSTI; NTIS; INIS; GPO Dep.

The ARGUS code is a three-dimensional code system for simulating for interactions between charged particles, electric and magnetic fields, and complex structure. It is a system of modules that share common utilities for grid and structure input, data handling, memory management, diagnostics, and other specialized functions. The code includes the fields due to the space charge and current density of the particles to achieve a self-consistent treatment of the particle dynamics. The physic modules in ARGUS include three-dimensional field solvers for electrostatics and electromagnetics, a three-dimensional electromagnetic frequency-domain module, a full particle-in-cell (PIC) simulation module, and a steady-state PIC model. These are described in the Appendix to this report. This project has a primary mission of developing the capabilities of ARGUS in accelerator modeling of release to the accelerator design community. Five major activities are being pursued in parallel during the first year of the project. To improve the code and/or add new modules that provide capabilities needed for accelerator design. To produce a User's Guide that documents the use of the code for all users. To release the code and the User's Guide to accelerator laboratories for their own use, and to obtain feed-back from the. To build an interactive user interface for setting up ARGUS calculations. To explore the use of ARGUS on high-power workstation platforms.

19178 (JINR-E–9-90-92) **Theory of accelerated orbits in AVF cyclotrons.** Tsenov, S.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1990. 16p. Order Number DE92626813. Source: OSTI; NTIS (US Sales Only); INIS.

The theory of accelerated orbits in AVF cyclotons through a fully six-dimensional hamiltonians formalism is developed. The design orbit of a particle, the betatron motion and the phase motion are calculated in linear approximation. The 'quasi-equilibrium orbit' and dispersion are studied in the framework of the Hamiltonian formalism. 8 refs.

19179 (JINR-R–9-90-65) **Some causes of electron-beam losses in a linear induction accelerator channel.** Rakityanskij, S.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 9p. (In Russian). Order Number DE92626814. Source: OSTI; NTIS (US Sales Only); INIS.

With the use of numerical simulation of the lateral coherent beam oscillations it is explored an influence of different axial summary breaking factors upon the channel transparency. Necessity of combination of the surfaces producing electric and magnetic beam images is established. To accuracy of the symmetry keeping there are formulated the indispensable requirements caused by the coherent oscillation development and the correspondent loss of accelerated particles. 5 refs.

19180 (KEK–91-9) **Single bunch beam breakup in linacs and BNS damping.** Toyomasu, Takanori (The Graduate Univ. for

Advanced Studies, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1991. 37p. Order Number DE92514987. Source: OSTI; NTIS (US Sales Only); INIS.

We study a single-bunch beam breakup (BBU) problem by a macro-particle model. We consider both the BBU solution and the Landau damping solution which includes the Balakin-Novokhatsky-Smirnov (BNS) damping. In the BBU solution, we get an analytic solution which includes both the Chao-Richter-Yao solution and the two-particle model solution and which agrees well with simulation. The solution can also be used in a multi-bunch case. In the Landau damping solution, we can be see the mechanism of Landau damping formally and can get some insights into BNS damping. We confirm that a two-particle model criterion for BNS damping is a good one. We expect that the two-particle model criterion is represented by the first order interaction in Landau damping solution of a macro-particle model. (author).

19181 (SAND–91-2285C) **A momentum limit for electromagnetic railguns.** Cowan, M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204102–6: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92011380. Source: OSTI; NTIS; GPO Dep.

We postulate that there is a required velocity of magnetic flux into a plasma-armature railgun to keep the armature from expanding toward the breech and thereby changing the nature of the forward-going force. Testing this idea with data from several guns we find confirmation, provided the required flux velocity increases with the square of the linear current density. This leads to the conclusion that these guns have a momentum limit while they are operating as true electromagnetic launchers. That limit is derived. High-performance railguns reach this limit during current rise, and most of their momentum comes from a hybrid phase. The hybrid phase has a pressure limitation at high velocity similar to electrothermal, light-gas, and powder guns. The 6 km/s "velocity limit" is explained by this pressure limitation.

19182 (SLAC-PUB–5747) **Measured emittance versus store time in the SLC damping ring.** Decker, F.J.; Emma, P.; Krejcik, P.; Limberg, T.; Minty, M.; Moshammer, H.; Raubenheimer, T.; Ross, M.; Seeman, J.T.; Siemann, R.; Spence, W.; Spencer, J.; Woodley, M. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–22: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012416. Source: OSTI; NTIS; INIS; GPO Dep.

Emittance studies at the SLC North Damping Ring led to precise measurements of the damping time using three independent methods. These measurements were done at three different locations: (1) in the ring using a fast gated video camera which allows the acquisition of the image of the synchrotron light from a single turn, (2) using the extracted beam and a single wire scanner in the ring-to-linac transport line, and (3) in the linac using four wire scanners. In addition the extracted beam emittance was studied as a function of various parameters. A significant dependence on the tune was observed.

19183 (SLAC-PUB–5766) **The coupled dipole modes of the NLC accelerator structure.** Bane, K.L.F.; Gluckstern, R.; Holtkamp, N. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–12: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011584. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed accelerator cavity of the Next Linear Collider (NLC) is a disk-loaded structure composed of 200 cells, operating at 11.42 GHz. The proposed mode of operation is to accelerate bunches in trains of 10, with a bunch spacing of 42 cm. One problem is that one bunch in a train can excite transverse wakefields in the accelerator cavity which, in turn, can deflect following bunches and result in emittance growth. A method of curing this problem is to detune the transverse modes of the cavity. Beam dynamics simulations for the NLC have shown that by keeping the transverse wakefield at the positions of the nine trailing bunches at or below 1 MW/nC/m^2 we can void emittance growth. Earlier, approximate calculations of the wakefields, which did not include the cell-to-cell coupling of the modes, have shown that by the proper Gaussian detuning the above level of cancellation can be achieved. A specific goal of this report is to see if this conclusion still holds when coupling is included in the calculation. Note that in this paper we focus on the modes belonging to the first dipole passband, which are the most important. A special feature of these modes in the detuned NLC cavity is that the cell-to-cell coupling changes sign somewhere in the middle of the structure.

19184 (SLAC-PUB–5781) **SSC beam dynamics scaled to the Eloisatron.** Ritson, D. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9111208–1: 19. INFN eloisation project: maximizing luminosity of hadron colliders at 100 TeV, Erice (Italy), 13-19 Nov 1991; SSCL-Preprint–85). Order Number DE92011585. Source: OSTI; NTIS; INIS; GPO Dep.

As crosssections drop as E^{-2} a desirable target for a 100 TeV the Eloisatron would be to achieve luminosities $\sim 1.10^{35}$ cm^2/sec. To understand the impact of such an objective we have compared parameters for the SSC and Eloisatron to differentiate areas which involve considerable extrapolations from current technologies from those which represent more conventional scale-ups. Synchrotron radiation losses per m for the same guide magnetic field associated with such luminosities would be up by $E^2 \times I$ where E is the energy and I is the circulating current. This would result in energy densities of ~250 times the nominal SSC values. The SSC is already limited by installed refrigeration power and if the circulating current was to be increased would have to use liners at liquid nitrogen temperatures to intercept the radiation as is proposed for the LHC. This issue was the subject of lively discussion at the workshop and is dealt with elsewhere by other authors. This author believed that the radiation could be intercepted by room temperature catchers spaced every 15–25 m around the ring. To obtain the requisite luminosities it assumes similar bunch spacing but circulating currents an order of magnitude larger than at the SSC. The SSC already uses a bunch spacing as small as 5 m and further reduction does not appear easy. The justification for the choice of bore for the magnets, emittances and attainable luminosities are discussed below. A further section looks into whether seismic ground disturbances might cause unacceptable emittance growth. The conclusion of this section is that careful use of current design practices should be adequate and that it is unlikely that exotic vibration free mounts will be required.

19185 (SLAC-PUB–5784) **Transverse wakefields at high dispersion.** Decker, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–4: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92010752. Source: OSTI; NTIS; INIS; GPO Dep.

In high energy linear colliders the transverse beam emittance has to be preserved in order to achieve small interaction spots. If the beam is off-center in an accelerating cavity, it excites transverse wakefields, mainly the dipole mode, which deflects the tail of the beam leading to an emittance growth. In a high dispersive region, even a well centered beam can excite wakefields of higher order modes since the energy spread of the beam causes a transverse beam size which is comparable with the beam pipe. During the bunch length compression in the ring-to-linac (RTL) section of the Stanford Linear Collider (SLC), the beam pipe of 75 mm diameter is practically filled in the horizontal plane. Especially, if beam losses start to be involved, the very outer parts of the beam excite wakefields at any pipe irregularities like bellows, diameter steps, etc. Measured evidences, theoretical estimates and comparisons to other effects, like higher order magnet optics, are presented.

19186 (SLAC-PUB–5789) **Calculations of emittance and damping time effects in the SLC damping rings.** Limberg, T.;

Moshammer, H.; Raubenheimer, T.; Spencer, J.; Siemann, R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–24: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012420. Source: OSTI; NTIS; INIS; GPO Dep.

In a recent NDR machine experiment the transverse emittance was studied as a function of store time and tune. To explain the observed transverse emittance damping time constants, the magnetic measurement data of the longitudinal field of the bending magnets had to be taken into account. The variation of the transverse emittances with tune due to misalignments and the associated anomalous dispersion is studied as well as the effect of synchrobetatron coupling due to dispersion in the RF cavities.

19187 (SLAC-PUB–5804) **A technique for aligning sextupole systems using beam optics.** Chao, Yu-Chiu. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–27: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012424. Source: OSTI; NTIS; INIS; GPO Dep.

A technique for beam based alignment of sextupole system is developed exploiting the enhancement effect of orbit differences by the sextupoles. This technique can in principle be applied to sextupole or sextupole strings with controlled orbit pattern and BPM configurations. This paper will discuss the theoretical basis, special optimization considerations and expected accuracy. Application to the SLC final focus is also discussed.

19188 (SSCL–530) **The physical solution to the Lorentz-Dirac equations in a constant magnetic field.** Endres, D. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Mathematics and Statistics). Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 20p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC35-89ER40486. Grant DMR-8704348. Order Number DE92013299. Source: OSTI; NTIS; INIS; GPO Dep.

The somewhat controversial Lorentz-Dirac equations for the motion of a radiating relativistic electron are shown to admit a unique physical solution in a constant uniform magnetic field perpendicular to the particle motion. In particular, the stable manifold of the origin in a four-dimensional velocity-acceleration phase space is shown to be globally the graph of a function mapping velocity to acceleration; solutions not in this manifold are shown to exhibit unphysical accelerations. Consequently, to each velocity there corresponds a unique physical acceleration determined by the stable manifold.

19189 (SSCL–570) **6-D phase space tracking with acceleration: Modeling low energy proton synchrotrons (I).** Machida, S. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE92013744. Source: OSTI; NTIS; INIS; GPO Dep.

Booster synchrotrons for high energy colliders and small proton synchrotrons mostly operate within the "low-energy" range from few 10 MeV up to about 10 GeV. A simulation code of both single- and multi-particle tracking has been developed especially for such machines. For the first time this code allows investigation of beam dynamics issues such as: (1) acceleration and synchrotron oscillations in fully 6-D phase space (2) transverse and longitudinal space-charge effects in 3-D real space, and (3) capture and bunching at injection and transition crossing with harmonic rf cavities. This paper describes the single-particle part of the code and presents some results on the Low Energy Booster (LEB) of the Superconducting Super Collider (SSC).

19190 (SSCL-Preprint–72) **A general control model for designing beam control feedback loops.** Mestha, L.K. (Superconducting Super Collider Lab., Dallas, TX (United States)); Webber, R.C.; Kwan, C.M. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315–19: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011696. Source: OSTI; NTIS; INIS; GPO Dep.

To control the beam in the synchrotron there may be six different primary feedback loops interacting with the beam at a given time. Three loops are local to the rf cavity. They are: high bandwidth cavity phase and amplitude loops used to minimize the effects due to beam loading and a low bandwidth cavity tuning loop. The loops global to the ring accelerating system are: a radial loop to keep the beam on orbit, a beam phase loop to damp the dipole synchrotron oscillations, and a synchronization loop to essentially lock with the succeeding machine. There are various ways in which these loops may be designed. Designs currently in use in operating machines are based on classical frequency domain techniques. To apply modern feedback controllers and study the interaction of all the feedback loops, a good mathematical model of the beam is extremely useful. In this paper we show the derivation of a non-linear tracking model in terms of differential equations obtained from a set of time varying finite difference equations. The model compares well with the results of thin element tracking codes.

4303 Auxiliaries and Components

Refer also to citation(s) 19134, 19162, 19164, 19176, 19244, 19246, 19247, 19248, 19249, 19250, 19251, 19265, 19274, 19277, 19281, 19324, 19333, 19359, 20132, 20133, 20168, 20300, 20442, 20452, 20459, 20460

19191 (ANL/APS/IN/VIB–89/2) **Preliminary vibration analysis of magnet/support system for 7-GeV APS storage ring.** Wambsganss, M.W. Argonne National Lab., IL (United States). 8 May 1989. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012379. Source: OSTI; NTIS; INIS; GPO Dep.

The storage ring quadrupoles, sextupoles, and correction magnets will be mounted on a common girder approximately 4.0 m long. The rigid girder, in turn, is mounted on three five-ton jacks, each of which is mounted on a pedestal that is grouted and bolted to the floor. For this preliminary analysis, we will assume that the girder has a weight per unit length of 100 lb/ft and a bending stiffness that is significantly greater than the vertical stiffness provided by the pedestal (jack-screw) supports. This allows us to approximate the magnet/support system as a rigid beam (girder) on spring supports (jack-screws) carrying distributed masses (magnets). These approximations permit us to study the rigid body translational and rotational (rocking) modes of the system. It should be noted that the preliminary design has two jack-screw supports at the left end and one at the right end. It should be noted that the magnet/support system studied is only a conceptual design. In actuality, there are five different magnet/support configurations comprising each of the 40 sectors of the storage ring. Also, it is expected that the details of the final design, in particular with respect to the positioning of the pedestal supports, will somewhat different. It should further be noted that a major assumption in the analysis is that the stiffness of the support beam with respect to the stiffness of the jack-screw supports is such that the support girder can be assumed rigid. To evaluate this assumption it is planned to perform a finite element analysis of the magnet/support system in which the flexibility of the support girder is included in the dynamic analysis.

19192 (ANL/APS/IN/VIB–89/3) **Vibration analysis of APS magnet/support systems based on the finite element method.** Chen, S.S.; Wambsganss, M.W. Argonne National Lab., IL (United States). 6 Mar 1989. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012174. Source: OSTI; NTIS; INIS; GPO Dep.

Prediction of the dynamic response of APS magnet/support systems requires knowledge of the free vibrational characteristics, including natural frequencies, modes, and modal damping ratios. A preliminary dynamic analysis of the magnet/support system of a typical section of the APS storage ring, as presented in the APS Conceptual Design Report, was performed to gain insight. The preliminary analysis is based on the assumption that the support girder could be considered rigid relative to the stiffness of the pedestal supports when considering the lower modes and frequencies. Further, only the vertical (in-plane) translational and rocking modes were studied. The subject analysis was performed to include the flexibility of the support girder and to investigate the horizontal (out-of-plane) modes as well. Also, the most up-to-date design of the five magnet sections are studied. Here, it should be noted that in the latest design the positioning of the support pedestals (jackscrews) is different from that in the conceptual design.

19193 (ANL/APS/IN/VIB–90/3) **Vibration study of the APS magnet support assemblies.** Wambsganss, M.W.; Jendrzejczyk, J.A.; Chen, S.S. Argonne National Lab., IL (United States). Nov 1990. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013068. Source: OSTI; NTIS; INIS; GPO Dep.

Stability of the positron closed orbit is a requirement for successful operation of the Advanced Photon Source. The fact that vibration of the storage ring quadrupole magnets can lead to distortion of the positron closed orbit and to potentially unacceptable beam emittance growth provides the motivation for the subject studies. Low frequency vibrations can be controlled with steering magnets using feedback systems, provided the vibration amplitudes are within the dynamic range of the controllers. High frequency vibration amplitudes, on the other hand, are out of the range of the controller and, therefore must be limited to ensure the emittance growth will not exceed a prescribed value. Vibration criteria were developed based on the requirement that emittance growth be limited to 10 percent. Recognizing that the quadrupole magnets have the most significant effect, three different scenarios were considered: vibration of a single quadrupole within the storage ring, random vibration of all the quadrupoles in the ring, and the hypothetical case of a plane wave sweeping across the site and the quadrupoles following the motion of the plane wave. The maximum allowable peak vibration amplitudes corresponding to these three vibration scenarios are given. The criteria associated with the passage of a plane wave is dependent on wavelength, or, alternatively, on frequency given the wave speed. The wave speed used is that measured as a part of the geotechnical investigation at the APS site.

19194 (ANL/APS/IN/VIB–91/1) **Vibration study of the APS storage ring vacuum-chamber/girder assembly.** Jendrzejczyk, J.A.; Wambsganss, M.W.; Smith, R.K. Argonne National Lab., IL (United States). Feb 1991. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012178. Source: OSTI; NTIS; INIS; GPO Dep.

The overall objective of this study is to obtain insights into the dynamic coupling between the storage ring vacuum chamber and girder, and an assessment of the potential for unacceptable vibration amplitudes that would require redesign of the vacuum chamber supports. Specific objectives include determination of the vibrational characteristics (natural frequencies and modes) of the coupled vacuum-chamber/girder system, measurement of response amplitudes to forced excitation and ambient floor motion, and calculation of magnification factors associated with the various coupled vibration modes. 1 ref.

19195 (ANL/APS/IN/VIB–91/2) **Vibration study of the APS storage ring 0.8 meter quadrupole/girder assembly.** Jendrzejczyk, J.A.; Wambsganss, M.W.; Smith, R.K. Argonne National Lab., IL (United States). May 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012172. Source: OSTI; NTIS; GPO Dep.

The overall objective of this study is to obtain insights into the dynamic coupled behavior of the quadrupole magnet and the girder assembly, and an assessment of the potential for unacceptable vibration levels which would require redesign of the quadrupole and/or girder mounting system(s). Specific objectives include determination of vibrational characteristics (natural frequencies, damping, mode shapes, and transfer functions) of the coupled magnet/girder system, measurement of response amplitudes of forced excitation and ambient floor motion, and calculation of magnification factors associated with the observed coupled vibration modes. In the Phase 1 tests the 0.8 meter quadrupole was mounted to the girder with a prototypic mount and excitation was primarily by an electromagnetic exciter or the result of ambient floor motion, with the exception of Test 7, which was impulse excited. In the Phase 2 tests the excitation was primarily by impulse with only a few tests with ambient floor excitation. A strong, coupled magnet/girder mode response occurs at frequency of 7.62 Hz resulting in very large magnification factors (low damping values) and large displacements. It appears that a low frequency rigid body mode of the magnet coincides with a girder mode frequency. The Phase 2 tests show the effect of jackscrew conditions on system response. When the pedestal bolts were loose, the jackscrew/pedestal assembly deflected slightly from its initial vertical position, resulting in a shift in position of the jackshaft within the screw assembly. The result was a significant reduction of frequency and a large increase in damping.

19196 (ANL/APS/IN/VIB–91/3) **Vibration study of the APS storage ring 0.8 meter quadrupole magnet/magnet support assembly.** Jendrzejczyk, J.A.; Wambsganss, M.W.; Smith, R.K. Argonne National Lab., IL (United States). Jun 1991. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012177. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this study are as follows: Determine the vibration characteristics (frequency, damping, and mode shapes) of the magnet on prototypic supports (the actual mounting system used to mount the magnet on the girder). Measure system response to ambient floor motion. Measure the effect of various modifications to determine if the magnet response can be modified to minimize unwanted response characteristics. Modifications investigated include support schemes, increasing system damping, and increasing mechanical rigidity. Measure system response to coolant flow. Determine vibrational characteristics of a large concrete block placed on a concrete floor, including response to ambient floor motions.

19197 (ANL/CP–75862) **Aperture coupling measurement in a test chamber for the Advanced Photon Source (APS).** Song, J.J.; Zhou, J.H.; Kustom, R.L. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920315–32: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92013059. Source: OSTI; NTIS; INIS; GPO Dep.

Aperture coupling measurements have been made using two identical rectangular chambers. A common wall between them has holes of various size, thickness, shape and number. The transverse electromagnetic (TEM) wave, which propagates in one rectangular chamber, couples through the aperture and radiates into the other chamber. The measured results are compared with the diffraction model and used to estimate the coupling impedance of a circulating beam. The results of these measurements was applied to the detailed design of some of the vacuum components in the Advanced Photon Source.

19198 (BNL–46332) **Design of a high-brightness, high-duty factor photocathode electron gun.** Lehrman, I.S. (Grumman Corp., Princeton, NJ (United States)); Birnbaum, I.A.; Fixler, S.Z.; Heuer, R.L.; Siddiqi, S.; Sheedy, E.; Ben-Zvi, I.; Batchelor, K.; Gallardo, J.C.; Kirk, H.G.; Srinivasan-Rao, T.; Warren, G.D. Brookhaven National Lab., Upton, NY (United States). Sep 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9108118–47: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92011003. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed UV-FEL user's facility at Brookhaven National Laboratory will require a photocathode gun capable of producing short (< 6 psec) bunches of electrons in high repetition rates (5 kHz), low energy spread (< 1.5.%), a peak current of 300 A (after compression) and a total bunch charge of up to 2 nC. At the highest charge the normalized transverse emittance should be less than 7 π mm-mrad. We are presently designing a gun that is expected to exceed these requirements. This gun will consist of $3\frac{1}{2}$ cells, constructed of GlidCop-15, an aluminum oxide dispersion strengthened copper alloy. The gun will be capable of operating at duty factors in excess of 1%. Extensive beam dynamics studies of the gun were used to determine the effect of varying the length of the first cell, shaping the apertures between cells, and increasing the number of cells. In addition, a detailed thermal and mechanical study of the gun was performed to ensure that the thermal stresses were well within the allowable limits and that copper erosion of the water channels would not occur.

19199 (BNL–47317) **Polarized wiggler for NSLS x-ray ring design considerations.** Friedman, A.; Krinsky, S.; Blum, E. Brookhaven National Lab., Upton, NY (United States). Mar 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92012212. Source: OSTI; NTIS; INIS; GPO Dep.

We examine the properties of an elliptically polarized wiggler that will generate circularly polarized photons with energy spectrum of 3–12 KeV. The vertical wiggler magnetic field is produced by permanent magnets while the horizontal wiggler field is generated by electric coils capable of AC excitation. The radiation parameters of the wiggler are presented, including photon flux, circular and linear polarization and spectrum. These parameters are compared to the synchrotron radiation from a bending magnet. Numerical values are calculated for radiation from the wiggler and bending magnet for the NSLS X-ray ring parameters. A conceptual design for such a wiggler is discussed and several different alternatives are analyzed. We consider AC excitation of the wiggler to produce the time modulation of the elliptic polarization, and also to produce time modulated linearly polarized radiation.

19200 (CONF-9105202–, pp. 22, Paper 17) **Linear collider RF structure design using ARGUS.** Kwok Ko (Stanford Linear Accelerator Center, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018677. Source: OSTI; NTIS; INIS.

In a linear collider, both the driving system (klystrons) and the accelerating system (linac) consists of RF structures that are inherently three-dimensional. These structures which are responsible for power input/output, have to satisfy many requirements in order that instabilities, beam or RF related, are to be avoided. At the same time, system efficiencies have to be maintained at optimal to minimize cost. Theoretical analysis on these geometrically complex structures are difficult and until recently, numerical solutions have been limited. At SLAC, there has been a continuing and close collaboration among accelerator physicists, engineers and numericists to integrate supercomputing into the design procedure which involves 3-D RF structures. The outcome is very encouraging. Using the 3-D/electromagnetic code ARGUS (developed by SAIC) on the Cray computers at NERSC in conjunction with supporting theories, a wide variety of critical components have been simulated and evaluated. Aside from structures related to the linear collider, the list also includes the RF cavity for the proposed Boson Factory and the anode circuit for the Cross-Field Amplifier, once considered as an alternative to the klystron as a possible power source. This presentation will focus on two specific structures: (1) the klystron output cavity; and (2) the linac input coupler. As the results demonstrate, supercomputing is fast becoming a viable technology that could conceivably replace actual cold-testing in the near future.

19201 (CONF-9105202–, pp. 7, Paper 20) **Simulation at the SSCL low energy booster and coupled cavity linac.** Bourianoff, G. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC35-89ER40486. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018677. Source: OSTI; NTIS; INIS.

During the past year, the SSC has made significant use of the MFE computer center for simulating the low energy accelerators in the SSC complex. There are two primary supercomputer applications reported here. They are the calculation of emittance growth in the LEB due to space charge effects and simulation of the side coupled cavities used in the linac. The SSC is designed to have a luminosity of 10^{33} interactions per second per square centimeter. It directly determines the amount of physics which can be done with the collider and is therefore of critical importance. The luminosity is inversely proportional to the emittance of the two colliding beams. Since emittance increases monotonically through the chain of accelerators, an emittance budget has been set up defining what the allowable emittance increase is in each individual component of the accelerator. The emittance budget for the LEB calls for the emittance to enter the LEB at .4π mm - mrad and leave the LEB at .6π mm -mrad. Therefore, a set of simulations was done to determine the actual emittance growth. The linac is designed to accelerate 25 MA of H^- ions from 70 MEV to 600 MEV. There are several possible cavity designs which might be used but the side coupled cavity design operating in the $\pi/2$ mode has a number of advantages concerning operating stability and ease of manufacture. It has therefore been chosen for the linac accelerator.

19202 (DESY–91-153) **Status report of a 500 GeV S-band linear collider study.** Balewski, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Bieler, M.; Bothe, W.; Bredehoeft, K.; Brinkmann, R.; Choroba, S.; Dwersteg, B.; Ebert, M.; Febel, A.; Fischer, R.; Floettmann, K.; Holzer, B.; Juergensen, H.; Kouptsidis, J.; KumpfDeutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 42p. Order Number DE92516969. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the status of a feasibility study of a 500 GeV center of mass linear collider, which is based almost entirely on conventional rf-technology. The basic components are S-band travelling wave, constant-gradient accelerating structures and 130 MW klystrons. 3 GeV damping rings are used to produce extremely small emittances in both planes which are in the same range as those of the next generation synchrotron light sources. Very strong focussing in the linear accelerator and near the interaction region, as well as a dedicated chromatic correction scheme, are necessary to achieve spot sizes that have not been produced yet. The methods envisaged to stabilize the motion of the tiny beam along the 15 km long linac seem promising and give rise to be assumption that the proposed values can be reached with todays' available technology. (orig.).

19203 (DOE/ER/40583–T2) **Development of low emittance high brightness electron beams and rf accelerating structures: Final technical report.** Pellegrini, C. California Univ., Los Angeles, CA (United States). Dept. of Physics. [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS03-90ER40583. Order Number DE92011125. Source: OSTI; NTIS; INIS; GPO Dep.

The main goals of this project were the construction of an S-band RF photoinjector for the production of a high brightness electron beam, and the development of a new type of RF accelerator structure; the Plane wave transformer. By the end of October 1991 the photoinjector had been built, its RF characteristics had been measured at low power, and an initial test of the gun at high RF power had been done. The Plane Wave Transformer had also been built and tested at lower power. In both cases the results obtained are mostly in agreement with the expected and calculated behavior.

19204 (FNAL/C–91/307) **Grounding and shielding in the accelerator environment.** Kerns, Q. Fermi National Accelerator Lab., Batavia, IL (United States). [1991]. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9110118–6: Accelerator instrumentation workshop, Newport News, VA (United States), 28-31 Oct 1991). Order Number DE92011759. Source: OSTI; NTIS; INIS; GPO Dep.

Everyday features of the accelerator environment include long cable runs, high power and low level equipment sharing building space, stray electromagnetic fields and ground voltage differences between the sending and receiving ends of an installation. This paper pictures some Fermilab installations chosen to highlight significant features and presents practices, test methods and equipment that have been helpful in achieving successful shielding. Throughout the report are numbered statements aimed at summarizing good practices and avoiding pitfalls.

19205 (FNAL-TM–1768) **Pump down rate for SRF cavities.** Kuchnir, M. (Fermi National Accelerator Lab., Batavia, IL (United States)); Knobloch, J. Fermi National Accelerator Lab., Batavia, IL (United States). Feb 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE92011703. Source: OSTI; NTIS; INIS; GPO Dep.

This note is about calculations aimed at quantifying adequate pumping speeds of evacuation of normally humid clean-room air from typical Superconducting Radiofrequency (SRF) cavities. The subject is of high relevance to the semiconductor industry, where the yield of VLSI (Very Large Scale Integration) chip production is affected by micron size particles which may cause fatal defects to their micron and sub-micron features. The recent availability of particle counters capable of operating in vacuum has stimulated measurements at reduced pressures in this subject.

19206 (GSI-91-63(prepr.)) **Non-Liouvillean method applied to heavy ion fusion.** Hofmann, I. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 13p. (CONF-9106260-: Symposium on high brightness beams for advanced accelerator applications, College Park, MD (United States), 6-7 Jun 1991). Order Number DE92516496. Source: OSTI; NTIS (US Sales Only); INIS.

Heavy ions are a challenging option for ICF driver accelerators. We focus on the rf linac /storage ring approach and an advanced scheme for indirectly driven targets. The main emphasis in on an increase of phase space density by means of a non-Liouvillean scheme using photoionization of single charged heavy ions. The required large cross sections are known to exist for Ba^+ stripped to Ba^{++}. In contrast with the non-Liouvillean injection methods proposed by previous authors, we discuss here photoionization for extraction from the storage ring into a compression ring, where the beam stays only a few revolutions. This promises a significant improvement of accelerator performance. Design examples for a full driver scenario as well as an experimental facility leading to an ignition experiment are presented. Experimental results pertaining to the longitudinal microwave instability as one of the key issues are reported and related to the design of an advanced driver accelerator scheme. (orig.).

19207 (INFN-TC-91-07) **TOPGUN: a new way to increase the beam brightness of rf guns.** Serafini, L. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)); Pagani, C.; Rivolta, R.; Ferrarion, M. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 36p. Order Number DE92626819. Source: OSTI; NTIS (US Sales Only); INIS.

A new method is presented to neutralize the RF induced emittance blow up generated inside RF electron Guns. The method is based on a multi-mode operation of the RF Gun cavity, which must be able to support both the accelerating mode ($TM_{010-\pi}$) and a higher harmonic mode. The analytical study of the beam dynamics, which has been found in good agreement with the numerical simulations, shows that the growth of the normalized rms emittance, produced by the time dependent RF forces during the acceleration in the Gun, can be cancelled up to fourth order terms. This is of great relevance for the improvement of RF Gun performances, since the RF field contribution to the emittance blow up becomes negligible and no more dependent on the unch size. As shown in this paper, with such a new Gun, which is called 'TOPGUN', the way to attain high brightness beams becomes straightforward.

19208 (INS-905) **Exotic Nuclei Arena in JHP.** Nomura, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1991. 13p. Order Number DE92514955. Source: OSTI; NTIS (US Sales Only); INIS.

The Exotic Nuclei Arena planned in Japanese Hadron Project aims to accelerate various unstable nuclei produced in 1-GeV proton-induced reactions up to 6.5 MeV/u by means of heavy-ion linacs. The present status of research and development for the Earena is briefly reported. The construction of the prototype facility to accelerate unstable beams up to 0.8 MeV/u is planned in 1992-94, in which the existing cyclotron in INS is used as the primary accelerator. (author).

19209 (INS-906) **Ion-optical design of the high-resolution mass separator for the Japanese Hadron Project.** Sunaoshi, Hitoshi (Tohoku Univ., Sendai (Japan). Dept. of Physics); Fujioka, Manabu; Shinozuka, Tsutomu; Wollnik, Hermann; Meuser, Stefan; Nomura, Toru; Kubono, Shigeru. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1991. 17p. Order Number DE92514956. Source: OSTI; NTIS (US Sales Only); INIS.

An ion-optical design of the JHP-ISOL is presented. This separator consists of a beam guidance system, a main magnetic separator stage and an electrostatic energy focusing stage. This separator is to be coupled with a heavy-ion linac for post-acceleration of mass separated ions up to 6.5 MeV/u. The design goal of the separator is to realize a mass resolving power of R_M = 20,000 (basal) at a transmission approaching 100 % with the initial phase space of ± 0.2 mm x ± 20 mrad. (author).

19210 (INS-907) **Ion trap project at INS.** Katayama, Ichiro; Wada, Michiharu; Tanaka, Junichi; Kawakami, Hirokane; Ohtani, Shunsuke. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1991. 12p. Order Number DE92514957. Source: OSTI; NTIS (US Sales Only); INIS.

We are developing an ion trap system for nuclear physics research at INS using lasers and a Penning trap. It has several important features, no specificity to ion species, fast response due to dynamic trapping and hopefully high trapping efficiency. (author).

19211 (IYaF-91-19) **'Laser string' monitor for measuring nonlinearity.** Levashov, Yu.I.; Mikhal'tsova, I.A.; Pupkov, Yu.A.; Fedotov, M.G. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1991. 18p. (In Russian). Order Number DE92624158. Source: OSTI; NTIS (US Sales Only); INIS.

Device for measuring nonlinearity of objects with the length of 50 m maximum within the range of ±2 mm, based on a new optical element has been created. Sources of possible measurement errors of the device are analyzed. Results of laboratory and production tests are presented. 13 refs.; 5 figs.

19212 (JINR-9-90-64) **Phasotron extracted proton beam transport to the target of wide-angle π-meson lens.** Abazov, V.M.; Bragin, A.N.; Gustov, S.A.; Mirokhin, I.V.; Mitsin, G.V.; Savchenko, O.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 4p. (In Russian). Order Number DE92626817. Source: OSTI; NTIS (US Sales Only); INIS.

Results on transport of phasotron extracted proton beam to the target of a wide-angle π-meson lens are described. A good agreement of calculated and experimental data is shown. Recommendations of the modification of the channel are considerd. The following parameters are obtained: 1)dimensions of the beam image at the meson-production target are 5 cm horizontally and 2 cm vertically (at level 2); 2)transmission coefficient is 0.91-0.94) 3)maximum permitted initial intensity of extracted proton beam for the echieved loss level as high as 2μA. 5 refs.

19213 (JINR-9-90-69) **Production and study of high-intensity meson beams for biomedical and physical investigations at the JINR phasotron.** Abazov, V.M.; Bragin, A.N.; Gustov, S.A.; Kutuzov, S.A.; Mirokhin, I.V.; Mitsyn, G.V.; Savchenko, O.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 10p. (In Russian). Order Number DE92626831. Source: OSTI; NTIS (US Sales Only); INIS.

The results of measurements of the meson beam composition and the estimation of the intensity of meson beam components including the surface muon beam are presented. The intensity of π^--mesons per a μA of the phasotron proton beam is about 2x10^{7} 1/sμA, that of μ^- mesons is ≈1.5x10^{6} 1/sμA. The variant to produce separation meson beams are considered. 12 refs.

19214 (JINR-9-90-107) **Calculations of the injection channel from LU-20 to the Nuclotron.** Beznogikh, Yu.D.; Vasilishin, B.V.; Govorov, A.I.; Kulikov, I.I.; Mikhajlov, V.A.; Monchinskij, V.A.; Seleznev, V.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 6p. (In Russian). Order Number DE92626820. Source: OSTI; NTIS (US Sales Only); INIS.

The calculation and obtained parameters of the injection channel from the LU-20 to the nuclotron are presented. The beam phase characteristics and horizontal dispersion in the nuclotron are provided. In the vertical plane the achromatic transfer from the linac to the nuclotron plane is realized. 2 refs.; 2 figs.

19215 (JINR-9-90-114) **Application of CCD-camera for size measuring of electron ring by means of synchrotron radiation.** Damish, Yu.; Drozdov, V.A.; Tyutyunnikov, S.I.; Shalyapin, V.N.

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1990. 6p. (In Russian). Order Number DE92626830. Source: OSTI; NTIS (US Sales Only); INIS.

The method is described and the results of measuring of electron ring density distribution are presented. A TV-camera on the basis of a CCD matrix is used as a sensing element. The camera is connected through the interface unit in CAMAC standard with the SM-4 computer. The time exposition of radiaiton is realized by using an electro-optic sutter in the time interval from 0.01 to 1 ms at an operation voltage of 1 kV. 5 refs.

19216 (JINR-13-90-63) **Noise-immunity light guide remote control system of an ion source.** Romanov, Yu.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 12p. (In Russian). Order Number DE92628169. Source: OSTI; NTIS (US Sales Only); INIS.

A ion source m noise - immunity light guide system with electrodrives of selective transmission of a command on one of 14 channels is described. To increase the noise - immunity of command's messages a radiation - improved fiber-optical channel of the quartz-polymer type and a number - impulse code with repetition protection. 11 refs.

19217 (JINR-R-1-90-75) **A system for beams transport from synchrophasotron and nuclotron to experimental set-ups No. 205.** Barteneva, N.A. (and others); Volobueva, T.I.; Kirillov, A.D. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 5p. (In Russian). Order Number DE92628170. Source: OSTI; NTIS (US Sales Only); INIS.

A scheme for accelerated particle beam trasnport from the MV-1 synchrophasotron and Nuclotron is presented. The positioning of the Nuclotron ring at 3.9 m level relatively to the lines of existing channels conditioned the development of beam vertical extraction system. Beam transport from the Nuclotron or the synchrophasotron to building 205 is ensured through a moving doublet of quadrupoles and magnet mounted on a rotating platform. 1 ref.

19218 (KEK-91-10) **Analysis of the prebuncher for the KEK 40-MeV proton linac.** Kato, Takao. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1991. 27p. Order Number DE92514988. Source: OSTI; NTIS (US Sales Only); INIS.

The electromagnetic fields of the prebuncher for the KEK 40-MeV proton linac have been studied using the code MAFIA. Part of the calculated results were compared with the experimental results. A beam simulation of the beam transport line between the prebuncher and the linac was performed using code LEBT; it runs on a supercomputer in order to calculate beam dynamics, including space-charge effects. The capture efficiency of the linac and the emittance growth in the beam line are discussed in connection with the space-charge effects. (author).

19219 (LA-UR-92-899) **What are good operators and why are they needed?.** Clay, M.E. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920315-11: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011235. Source: OSTI; NTIS; INIS; GPO Dep.

Sophisticated computer control and automation have made possible the operation of today's enormously complex particle physics facilities. Yet with all of the versatility that this sophisticated technology provides, it would be difficult, if not impossible, for these facilities to attain even minimum required operational goals without the constant supervision and regular intervention of human operators. Furthermore, if operational goals are to be pushed to new limits, then human operators with rare, esoteric talents and skills, commonly referred to as good operators, are required. The need for these operators, together with a discussion of the qualities associated with good operators, are the subjects of this paper.

19220 (LA-UR-92-905) **High intensity negative proton beams from a SNICS ion source.** Evans, C.R.; Hollander, M.G. Los Alamos National Lab., NM (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9110258-5: Symposium of northeastern accelerator personnel, Albuquerque, NM (United States), 15-19 Oct 1991). Order Number DE92011137. Source: OSTI; NTIS; INIS; GPO Dep.

For the past year we have been involved in a project to develop an intense (> $100\mu A$) negative proton beam from a SNICS (Source of Negative Ions by Cesium Sputtering) ion source. This report will cover how we accomplished and exceeded this goal by more than 40%. Included in these observations will be the following: A description of an effective method for making titanium hydride cathodes. How to overcome the limitations of the titanium hydride cathode. The modification of the SNICS source to improve output; including the installation of the conical ionizer and the gas cathode. A discussion of problems including: poisoning the proton beam with oxygen, alternative gas cathode materials, the clogging of the gas inlet, long burn-in times, and limited cathode life times. Finally, how to optimize source performance when using a gas cathode, and what is the mechanism by which a gas cathode operates; facts, fantasies, or myth.

19221 (SAND-91-1624) **Repetitive High Energy Pulsed Power (RHEPP) Temperature Monitoring System utilizing Luxtron fluoroptic sensors and thermocouples technical reference manual.** Laderach, G.E. Sandia National Labs., Albuquerque, NM (United States). Jan 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013461. Source: OSTI; NTIS; GPO Dep.

This document describes the Temperature Monitoring System for the RHEPP project at Sandia National Laboratories. The system is designed to operate in the presence of severe repetitive high voltage and electromagnetic fields while providing real time thermal data on component behavior. The thermal data is used in the design and evaluation of the major RHEPP components such as the magnetically switched pulse compressor and the linear induction voltage adder. Particular attention is given to the integration of commercially available hardware and software components with a custom written control program. While this document is intended to be a reference guide, it may also serve as a template for similar applications. 3 refs.

19222 (SAND-91-1626) **Plasma channel generation using low energy electron beams.** Kiekel, P.D. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 19p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013770. Source: OSTI; NTIS; INIS; GPO Dep.

A channel ions can focus and guide a relativistic electron beam. This report discuses the generation of plasma channels using magnetically confined low energy electron beams in a low pressure gas. The most significant advantages of these channels are that any gas can be ionized and that they can easily be made to follow a curved path. The major advantages are that the channel is less well confined than a laser produced channel and that a small solenoidal magnetic field is required. This report is intended to be a guide for those technicians and scientists who need to assemble and operate an e-beam generated plasma channel system. Hardware requirements are discussed in detail. There are brief discussions of operating techniques, channel diagnostic, and channel characteristics.

19223 (SAND-91-2208C) **Solid-armature railguns without the velocity-skin effect.** Cowan, M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204102-8: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92012630. Source: OSTI; NTIS; GPO Dep.

If the velocity-skin effect could be eliminated, solid-armature railguns might reach high velocity (≥ 6 km/s) without forcing most of the armature current to pass through an arc. Even then, magnetic diffusion (the "normal" skin effect) will limit acceleration. In this paper, the performance limits for railguns which are free from the velocity-skin effect are investigated by deriving the upper limits for a specific kind of power supply. Previous performance estimates made for solid-armature railguns are examined in the light of these results and are found to be relatively very optimistic. A railgun design which limits the velocity-skin effect and which may allow improved performance for solid armatures is described. 6 refs.

19224 (SAND–92-0117C) **Survivable debris shields for laboratory soft x-ray simulation sources.** Spielman, R.B.; Farnsworth, A.V. Jr.; Gustwiller, J.S.; Hedemann, M.A.; Hermina, W.L.; Hussey, T.W.; Lorence, L.J.; Pepping, R.E.; Reilly, J.P.; Reynolds, F.D.; Scrivner, G.J.; Sharpe, A.W.; Thornton, A.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920223–6: 1992 hardened electronics and radiation technology (HEART) conference, Albuquerque, NM (United States), 24-28 Feb 1992). Order Number DE92011379. Source: OSTI; NTIS; INIS; GPO Dep.

A survivable debris shield is necessary if very high levels of cleanliness are to be achieved on samples exposed to soft x rays from laboratory simulation sources. These samples, often of optical quality, require a low or zero debris environment in order to distinguish low levels of soft x-ray damage from debris-induced effects. We will describe the development of survivable debris shield technology on the Sandia National Laboratories' Saturn x-ray simulation facility, which permits ultraclean exposure over sample areas of 58 cm^2 @ ~0.35 cal/cm^2, 5 cm^2@ ~0.8 cal/cm^2, cm^2, 2.8 cm^2 @ ~1.2 cal/cm^2, and 0.8 cm^2 @ ~1.5 cal/cm^2 with 3-keV argon K-shell photons. These new fluence-area produce test capabilities represent an order-of-magnitude improvement in the state of the art (previously 0.25 cm^2 @ ~ 1 cal/cm^2 or 1.0 cm^2 @ ~0.35 cal/cm^2) for soft x-ray simulators.

19225 (SLAC-PUB–5649) **Pulse-by-pulse energy measurement at the Stanford Linear Collider.** Blaylock, G. (California Univ., Santa Cruz, CA (United States)); Briggs, D.; Collins, B.; Petree, M. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9201101–1: SEAM '92: Scientific and Engineering Applications of the McIntosh technical conference and exposition, San Francisco, CA (United States), 15-17 Jan 1992). Order Number DE92011520. Source: OSTI; NTIS; INIS; GPO Dep.

The stanford Linear Collider (SLC) collides a beam of electrons and positrons at 92 GeV. It is the first colliding linac, and produces Z^0 particles for High-Energy Physics measurements. The energy of each beam must be measured to one part in 10^4 on every collision (120 Hz). An Energy Spectrometer in each beam line after collision produces two stripes of high-energy synchrotron radiation with critical energy of a few MeV. The distance between these two stripes at an imaging plane measures the beam energy. The Wire- Imaging Synchrotron Radiation Detector (WISRD) system comprises a novel detector, data acquisition electronics, readout and analysis. The detector comprises an array of wires for each synchrotron stripe. The electronics measure secondary emission charge on each wire of each array. A Macintosh II (using THINK C, THINK Class Library) and DSP coprocessor (using ANSI C) acquire and analyze the data, and display and report the results for SLC operation.

19226 (SLAC-PUB–5760) **A three-gap klystron output cavity at X-band.** Ko, K. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Lee, T.G.; Tonegawa, S.; Kroll, N. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ;AS03-89ER40527. (CONF-920124–23: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92012417. Source: OSTI; NTIS; INIS; GPO Dep.

A high-power X-band klystron employing a double-gap output cavity has been operating at SLAC. Multi-gap output circuits have lower surface gradients at the interaction gaps than single-gap ones but are prone to self-oscillate due to negative loading and trapped higher-order modes. In the double-gap circuit design, considerable attention had been directed to deal with these stability problems. The performance of the present tube appears to be limited by gap breakdown and beam interception particularly at long pulses. A three-gap output cavity is currently under development to further reduce the gap surface gradient. Another new feature of the circuit is an enlarged downstream drift tube to improve on beam clearance. This paper discusses the considerations involved in designing a multi-gap output cavity and presents the cold test measurements on the three-gap circuit. The experimental data is compared with numerical results from the 3-D simulation code ARGUS.

19227 (SLAC-PUB–5764) **Precision fiducialization of transport components.** Fischer, G.E.; Bressler, V.E.; Cobb, J.K.; Jensen, D.R.; Ruland, R.E.; Walz, H.V.; Williams, S.H. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–10: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92010746. Source: OSTI; NTIS; INIS; GPO Dep.

The Final Focus Test Beam (FFTB) is a transport line designed to test both concept and advanced technology for application to future linear colliders. It is currently under construction at SLAC in the central beam line. Most of the quadrupoles of the FFTB have ab initio alignment tolerances of less than 30 microns, if the planned for beam based alignment tuning procedure is to converge. For such placement tolerances to have any meaning requires that the coordinates of the effective centers, seen by the beam particles, be tansferred to tooling (that can be reached by mechanical or optical alignment methods) located on the outside of the components to comparable or better values. We have constructed an apparatus that simultaneously locates to micron tolerances, the effective magnetic center of fussing lenses, as well as the electrical center of beam position monitors (BPM) imbedded therein, and once located, for transferring these coordinates to specially mounted tooling frames that supported the external retroreflectors used in a laser tracker based alignment of the beam line. Details of construction as well as experimental results from the method are presented.

19228 (SLAC-PUB–5768) **The polarized electron gun for the SLC.** Schultz, D.C.; Clendenin, J.; Frisch, J.; Hoyt, E.; Klaisner, L.; Woods, M.; Wright, D.; Zolotorev, M. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–23: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012418. Source: OSTI; NTIS; INIS; GPO Dep.

A new polarized electron gun for use on the SLC at SLAC has been built and tested. It is a diode gun with a laser driven GaAs photocathode. It is designed to provide short (2ns) pulses of 10 A at 160 kV at 120 Hz. The design features of the gun and results from a testing program on a new and dedicated beam line are presented. Early results from operation on the SLC will also be shown.

19229 (SLAC-PUB–5775) **Injection system for the PEP II asymmetric B Factory at SLAC.** Fieguth, T. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Bloom, E.; Bulos, F.; Davies-White, W.; Donald, M.; Fairfield, K.; Godfrey, G.; Holtzapple, R.; Hutton, A.; Loew, G.; Miller, R.; Sukiennicki, B.; Wen, H.; Ronan, M.; Zisman,Stanford Linear Accelerator Center, Menlo Park, CA (United States); Lawrence Berkeley Lab., CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ;AC03-76SF00098. (CONF-920315–25: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992; LBL–32075). Order Number DE92012419. Source: OSTI; NTIS; INIS; GPO Dep.

The asymmetric energy B Factory proposed as an upgrade of PEP at Stanford Linear Accelerator Center will require a highly reliable and efficient injection system. The conceptual design has shown the feasibility of extracting 9 GeV electrons and 3.1 GeV positrons from the existing linac and injecting equal charges into 1658 buckets in each of the two rings of the collider. An injection study group has continued the development and study of this proposal and has generated workable designs for many related systems and subsystems.

19230 (SLAC-PUB–5780) **High resolving power spectrometer for beam analysis.** Moshammer, H.W.; Spencer, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315–5: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92010751. Source: OSTI; NTIS; INIS; GPO Dep.

We describe a system designed to analyze the high energy, closely spaced bunches from individual RF pulses. Neither a large solid angle nor momentum range is required so this allows characteristics that appear useful for other applications such as ion beam lithography. The spectrometer is a compact, double-focusing QBQ design whose symmetry allows the Quads to range between F or D with a correspondingly large range of magnifications, dispersion and resolving power. This flexibility insures the possibility of spatially separating all of the bunches along the focal plane with minimal transverse kicks and bending angle for differing input conditions. The symmetry of the system allows a simple geometric interpretationof the resolving power in terms of thin lenses and ray optics. We discuss the optics and the hardware that is proposed to measure emittance, energy, energy spread and bunch length for each bunch in an RF pulse train for small bunch separations. We also discuss how to use such measurements for feedback and feedforward control of these bunch characteristics as well as maintain their stability. 2 refs.

19231 (SLAC-PUB-5782) **A high-power SLED 2 pulse compression system.** Kroll, N.M. (California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics); Farkas, Z.D.; Lavine, T.L.; Menegat, A.; Ruth, R.D.; Wilson, P.B.; Nantista, C. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ;AS03-89ER40527. (CONF-920315-13: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011586. Source: OSTI; NTIS; INIS; GPO Dep.

The enhancement of peak power by means of RF pulse compression has found important application for driving high energy electron linacs, the SLAC linac in particular. The SLAC Energy Doubler (SLED), however, yields a pulse shape in the form of a decaying exponential which limits the applicability of the method. Two methods of improving this situation have been suggested: binary pulse compression (BPC), in which the pulse is compressed by successive factors of two, and SLED II in which the pair of resonant cavities of SLED are replaced by long resonant delay lines (typically waveguides). Intermediate schemes in which the cavity pair is replaced by sequences of coupled cavities have also been considered. In this paper we describe our efforts towards the design and construction of high-power SLED II systems, which are intended to provide drivers for various advanced accelerator test facilities and potentially for the Next Linear Collider itself. The design path we have chosen requires the development of a number of microwave components in overmoded waveguide, and the bulk of this paper will be devoted to reporting our progress.

19232 (SLAC-PUB-5806) **Review of pulsed rf power generation.** Lavine, T.L. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Apr 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920315-26: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92012422. Source: OSTI; NTIS; INIS; GPO Dep.

I am going to talk about pulsed high-power rf generation for normal-conducting electron and positron linacs suitable for applications to high-energy physics in the Next Linear Collider, or NLC. The talk will cover some basic rf system design issues, klystrons and other microwave power sources, rf pulse-compression devices, and test facilities for system-integration studies.

19233 (SSCL-561) **Accelerator System String Test (A.S.S.T.) Interconnect Region cold mass connection analysis.** Mendoza, R. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE92011767. Source: OSTI; NTIS; INIS; GPO Dep.

Two-dimensional axisymmetric linear and nonlinear ANSYS finite element models of the A.S.S.T. Interconnect Region cold mass connection piping sleeve and flange and their adjoining weld (Drawings M30-000499A and M30-000573A) have been developed. These models indicate that a strong, highly localized stress concentration occurs at the interface region of the weld and sleeve parent metal (heat affected zone), at the inner diameter of the sleeve. Therefore, fatigue crack propagation has also been studied. For loading characteristics of 177 N/rad (250 lb total) axial force and 2.533 MPa (25 atm) internal pressure, an initial circumferential crack of 0.15 mm or less will not propagate through the 2 mm thickness of the sleeve within the 150 cycle design lifetime.

19234 (SSCL-Preprint-74) **Beam position monitor electronics using DC coupled demodulating logarithmic amplifiers.** Aiello, G.R.; Mills, M.R. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-18: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011697. Source: OSTI; NTIS; INIS; GPO Dep.

An electronics circuit operating up to 120 MHz suitable for Beam Position Monitor signal processing is described. Two different channels process signals from the electrodes. Each channel is realized with two cascaded DC coupled demodulating logarithmic amplifiers, providing an output voltage proportional to the logarithm of the input signal amplitude. The outputs from the two channels are processed by differential and summing amplifiers. The difference output produces a voltage proportional to the beam displacement between the electrodes, but both the difference and sum outputs are digitized in order to allow for a software correction of the gain and offset mismatches. The electronics show better characteristics than previous implementations utilizing log-amp circuits. The dynamic range has been increased, keeping the linearity error smaller than 1% over a 65 dB input signal range. The noise characteristics have been improved providing good resolution at low currents. The RF burst response has also been tested showing good characteristics for use on a Linac or Transfer Line. One prototype, working at 60 MHz, has been built and is planned for use on one or more machines at the SSC.

19235 (SSCL-Preprint-75) **A technique for performing the assembly alignment of the SSC dipole magnets.** Viola, R. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-14: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011695. Source: OSTI; NTIS; INIS; GPO Dep.

An optical alignment system was developed for use during the assembly of the SSC dipole magnets. The system is designed to ensure that a finished magnet's cold mass is level, has the correct sagitta, and is in the proper location relative to the magnet's vacuum vessel. Additionally, this system is capable of precisely determining the off-sets between the magnetic center line and the vacuum vessel's external fiducial points. Major system components are described and the alignment procedure is outlined. The uncertainties associated with each phase of measurement are presented.

19236 (SSCL-Preprint-76) **A time domain control algorithm for global rf feedback loops.** Mestha, L.K. (Superconducting Super Collider Lab., Dallas, TX (United States)); Mangino, J.; Kwan, C.M.; Young, K.S. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-15: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011694. Source: OSTI; NTIS; INIS; GPO Dep.

Phase-locking the Low Energy Booster to the Mechanism Energy Booster using "Trip-plan" approach is under development. With this scheme it is possible to phase lock the two machines at any time while ramping, even with wide frequency range in the low energy machines. This loop also has the potential to damp the phase oscillations and keep the beam in orbit by using the Low Energy Booster beam signal and a master clock as two moving references. A brief description of the bench test loop set up and the experimental results are shown in this paper to demonstrate the idea. We have investigated the ability of the loop to damp oscillations and also synchronize reference bunches. With the use of special algorithms it looks possible to operate the machine without the radial and beam phase loop. The implementations of such a scheme depends on the computational speed of the processors and the ability of fast Direct Digital Synthesizers to produce the guiding RF signal.

19237 (SSCL-Preprint-78) **Low energy booster main magnet power supply system.** Jach, C.; Winje, R.; Tacconi, E.; Harold, R.; Smedley, K. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-17: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011693. Source: OSTI; NTIS; INIS; GPO Dep.

The Low Energy Booster (LEB) is rapid cycling synchrotron to be built at the Superconducting Super Collider Laboratory in the injector complex. The Low Energy Booster will be ready for operation by late 1955. The LEB is used to accelerate protons from an injection momentum of 1.2 GeV/c to an extraction momentum of 12 GeV/c. The machine is a separated function design with dipole and quadrupole magnets driven by a single power supply system. Tracking errors between dipoles and quadrupoles are corrected by corrector quadrupole magnets powered from independent power supplies. The dipoles and quadrupoles are excited with a 10 Hz biased sine wave or 1 Hz linear ramp. Change of operating mode from 10 Hz takes no more than 2 hours. This paper describes the present design of the ring magnet power supply system.

19238 (SSCL-Preprint-79) **Improved ferrite biasing scheme for booster rf cavities.** Schaffer, G. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-20: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011650. Source: OSTI; NTIS; INIS; GPO Dep.

A new engineering design of ferrite tuners for rapid-cycling-booster rf cavities is proposed. The basic concept is to divide a perpendicularly biased ferrite tuner into two (or more) successive or parallel sections which are magnetically biased in opposite directions. This approach aims at several improvements with respect to existing designs: (a) reduction of magnet weight (b), lower eddy currents, (c) reduction (or cancellation) of magnetic fields on beam axis, and (d) possibility of increasing the tuner breakdown voltage by stepwise widening of airgaps between ferrite layers of successive tuner sections. Some details are illustrated for stripline tuners, especially for the Low-Energy- and Medium-Energy-Boosters (LEB and MEB) in the Supercollider injector scenario.

19239 (SSCL-Preprint-80) **Application of superconducting cavities to the collider rings of the SSC.** Schaffer, G. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920315-16: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92011692. Source: OSTI; NTIS; INIS; GPO Dep.

The rf parameters of the SSC collider rings are briefly characterized by 20 MV peak rf voltage, 3.9 MeV acceleration per turn, and 2 MW rf power ring at a multiple of the 60-MHz bunch frequency of the proton beam injector. 360 or 480 MHz are preferred frequency choices. In the references design, a normalconducting accelerating structure is foreseen which would operate with gradients of typically 1 MV/m. In contrast to this, superconducting cavities can generate fields of 5 MV/m, or possibly more. In combination with a low R/Q-value, the total stored energy in the rf structure could be increased by an order or magnitude. This would help to reduce the undesired effects of transient beam loading, of rf generator noise, and of imperfections in the generator feedforward current, resulting in reduced phase modulation of the particle bunches at the collision area. For 70 mA circulating beam current, eight superconducting single-cell cavities would be required per ring, instead of 32 to 40 single-cell normalconducting cavities. The savings in tunnel space, and a lower coupling impedance would allow a later upgrade of the beam current to and beyond 200 mA, if desired, for a higher collider luminosity.

19240 (UCRL-ID-109283) **Projectile development for railguns using hypervelocity preacceleration.** Susoeff, A.R. (Lawrence Livermore National Lab., CA (United States)); Hawke, R.S.; Sauve, G.L.; Konrad, C.H.; Hickman, R.J. Lawrence Livermore National Lab., CA (United States). 1 Feb 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012410. Source: OSTI; NTIS; GPO Dep.

The STARFIRE Project is a joint Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) effort to achieve hypervelocity projectile launches up to 15 km/s. The apparatus used to achieve this goal is a three stage acceleration system made up of a two-stage light-gas gun (2SLGG) is used as a preaccelerator capable of injecting 2 gram projectiles at velocities of 6 km/s or more. Projectiles used in this environment are subject to many conditions. Some of these which effect projectile design include: acceleration loading, structural response, barrel condition and alignment. Development of a projectile to satisfy the programmatic requirements is underway. This report covers the evolution of design and fabrication for railgun projectiles from previous experience at LLNL to the replenished plasma armature and projectile now used on STARFIRE. Projectile design, development and fabrication methods which use off-the-shelf materials and standard techniques to meet the operational criteria of the experimental program are discussed in this paper. Initial work involving the design and fabrication of skirted projectiles, which are expected to further reduce interaction phenomena between the plasma armature and railgun barrel, is also described.

19241 (UCRL-JC-109672) **A mechanical connector design for high-current, high-coulomb pulsed power systems.** Susoeff, A.R.; Hawke, R.S.; Leighton, K.S. Lawrence Livermore National Lab., CA (United States). 25 Feb 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC04-76DP00789. (CONF-9204102-7: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92012678. Source: OSTI; NTIS; GPO Dep.

A technique to make reliable high-current, high-coulomb electrical contact was developed for transmitting power into railguns. The method uses spring loaded removable connectors that are installed independently from the launcher. The simple rod-type design and absence of fastener holes allow maximum utilization of material mechanical properties. Repeated experiments with 9.5-mm diameter connectors demonstrated reliable pulsed charge transfer of 200 coulombs at currents of over 400kA. 20 refs.

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Refer also to citation(s) 19197, 20058, 20132, 20134

19242 (ANL/CP-75861) **RF impedance measurement status for the 7-GeV Advanced Photon Source (APS).** Song, J.J.; Kustom, R.L. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920315-31: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE92013060. Source: OSTI; NTIS; INIS; GPO Dep.

Beam-coupling impedances (Z) for the 7-GeV APS storage ring have been numerically estimated. In order to confirm these calculations, the wire method with a synthetic pulse technique was used to measure the beam coupling impedance of various vacuum components around the main storage ring. A section of the beam+antechambers, a vacuum isolation valve with and without the RF shielding screen, an insertion device, and a photon absorber were used as a device under test (DUT) to obtain the results. The results were compared with the computer simulations and the Z or k-dependence on bunch lengths was studied.

19243 (BNL-46615, pp. 1-13) **Introduction.** Krinsky, S. (Brookhaven National Lab., Upton, NY (United States)); Bittner, J.; Fauchet, A.M.; Johnson, E.D.; Keane, J.; Murphy, J.; Nawrocky, R.J.; Rogers, J.; Singh, O.V.; Yu, L.H. Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288-1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

Research utilizing synchrotron radiation was initially carried out parasitically on synchrotrons and storage rings designed and operated for high energy physics. The National Synchrotron Light

Source (NSLS) at Brookhaven National Laboratory was one of the first facilities developed as a dedicated synchrotron radiation source. The NSLS facility is comprised of an 80 MeV electron linac which injects into a small (28-m circumference) booster synchrotron which accelerates the electrons up to 750 MeV. The booster serves as a full energy injector for the VUV storage ring, which operates at 750 MeV to provide radiation in the ultraviolet and soft X-ray regions of the spectrum. The booster also is used to inject electrons into the X-ray storage ring which operates at 2.5 GeV providing hard X-rays. Based upon the work of G.K. Green and R. Chasman the NSLS storage rings were designed to maximize the brightness of the synchrotron radiation source, i.e. maximize photons/sec/phase-space volume/unit bandwidth. The fundamental importance of brightness as a figure of merit of the radiation source is that brightness is left invariant by linear focusing optics. The photon beam can be focused to a small spot size at the expense of introducing a large angular divergence, or can be made very parallel at the expense of increasing the spot size. However, if an experiment requires an intense highly parallel photon beam incident on a small sample, then a high brightness source is required. In order to provide a high source brightness, the NSLS storage rings were designed to have small emittance. This was accomplished by using the Chasman-Green lattice design which utilizes achromatic bends with zero-dispersion insertions bounded by quadrupole doublets in the VUV ring and quadrupole triplets in the X-ray ring. The lattice functions for the VUV and X-ray rings are given.

19244 (BNL--46615, pp. 14-20) **Transverse beam profile monitor.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288--1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

During the commissioning and operation of an electron storage ring it is useful to be able to measure the transverse profile of the electron beam. The vertical and horizontal beam sizes yield information about the beta functions and emittance. The vertical size and skewness of the beam profile are measures of the horizontal-vertical coupling. Transverse instabilities can be observed as they occur even if they have no dipole moment and go undetected by pickup electrodes or striplines, and ion trapping is easily detected as a vertical expansion of the beam. A non-destructive way of determining the beam profile is by imaging the synchrotron radiation produced in the bending magnets. The optical intensity of the profile in the image plane is proportional to the electron density in the source plane. Several means of producing an image are possible, including using zone plates or curved grazing-incidence mirrors to focus X-rays; pinholes to collimate X-rays; or lenses to focus visible light. The last two methods are the simplest and the authors will describe them in more detail.

19245 (BNL--46615, pp. 21-26) **Bunch length measurements in the VUV storage ring.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288--1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

Measurements of the bunch length have been made as part of a study of current-dependent phenomena to provide a complete characterization of the VUV ring. Scaling laws have been put forth for the anomalous bunch lengthening with current which is generally observed in storage rings. However, there is no complete theory of the lengthening phenomenon and it is of great interest to compare the behavior of existing machines to the scaling laws. In addition, high peak currents are sought both for damping rings for linear colliders and for free-electron laser drivers and might be achieved through low-momentum compaction lattices. Finally since the bunch lengthening depends on the vacuum chamber. The accepted scaling law of bunch length with current contains the RF voltage, electron energy and momentum compaction. The VUV ring was particularly interesting for such measurements because one could separately and easily vary both the electron energy and the momentum compaction. Although the ring is injected at full energy (750 MeV) the authors have had extensive experience running the ring at low-energy (as low as 80 MeV) for the TOK project. In the following they discuss their measurement technique. The low current bunch length in operational conditions is on the order of 170 psec (σ), i.e., comparable to or longer than the vacuum pipe's smallest dimension, and allows a simple measurement. They present data of bunch length versus current (up to 500 mA in a single bunch), varying electron energy and momentum compaction. Finally, a fit of the data with the Chao-Gareyte model is discussed.

19246 (BNL--46615, pp. 27-37) **Photoelectric effect photon beam position monitors.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288--1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

Stability of the electron orbit is of critical importance at the NSLS. Many experimenters utilizing the NSLS photon beams can take full advantage of the small transverse dimensions of the source only if the electron orbit variation is kept below 10 to 20% of the transverse electron bunch size. Clearly the first step in a program to stabilize the orbit is to develop position monitors with the required sensitivity, reliability and dynamic range. Of great importance are monitors detecting the photon beams themselves, and also monitors measuring the position of the electron beam. In this section the authors discuss photon beam position monitors utilizing the photoelectric effects, and in the following section the use of capacitively coupled pick-up electrodes to detect electron beam position will be described. In what follows they shall proceed to consider two generic types of monitor geometries (1) Gap monitors, which are designed with the idea that the fringes of the synchrotron radiation will be measured, and the hot or fundamental beam will pass through the monitor unimpeded. (2) Area monitors, which are comprised of two triangular elements nested together similar to the electrodes of a split ion chamber or the diodes described by Siddons and Kraner or Mitsuhashi et al.

19247 (BNL--46615, pp. 38-46) **Receivers for processing electron beam pick-up electrode signals.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288--1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

There are several methods of determining the transverse position of the electron beam, based upon sensing either the electric field, the magnetic field, or both. At the NSLS the transverse beam position monitors each consist of a set of four circular electrodes. There are 48 sets of pick-up electrodes in the X-ray ring and 24 in the VUV storage ring for determining the electron orbit, and a few extra sets installed for specialized purposes. When the beam passes between the four electrodes, charge is induced on each electrode, the amount depending upon the distance of the beam from that electrode. If V_a, V_b, V_c and V_d given by a difference between pairs of electrodes normalized for variations in beam current by dividing by the sum of electrode voltages. The method of processing these signals depends upon their time structure. The electrons circulating around the vacuum chamber are concentrated in short bunches within stability buckets produced by the accelerating voltage in the RF cavities. The charges induced on the pickup electrodes then are narrow pulses, a fraction of a nanosecond long, and would result in a monopolar voltage pulses if it were not for the impedance of the cable connecting the electrode to the processing apparatus. The capacitance between each electrode and the chamber wall is only a few picofarads and is effectively in parallel with the cable impedance (50 ohms). Thus an appreciable amount of the charge flows off the electrode while the bunch is between the electrodes, resulting in potential of opposite sign as the bunch is leaving the vicinity of the electrode. The resulting signal consists of a series of bipolar pulses, each of less than one nanosecond duration.

19248 (BNL--46615, pp. 47-57) **Real time global orbit feedback system.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288--1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

Stability of the electron orbit is essential for the utilization of a low emittance storage ring as high brightness radiation source. For an individual user, the required orbit stability can be achieved by a local bump feedback system. However, to install local bump feedback systems for every beamline is both costly and impractical. The coupling between different local bumps may introduce instability, and there may not be enough space for the large number of trim coils required. Here the authors discuss an approach for improving the stability of the closed orbit, by implementing a feedback system based upon harmonic analysis of the orbit movements and the correction magnetic fields. This harmonic feedback system corrects the Fourier components of the orbit nearest to the betatron tune, an approach which yields an orbit whose stability is sufficient for most experiments. The needs of the experiments requiring the tightest orbit tolerances can still be dealt with by additional local orbit feedback systems. Harmonic orbit correction is an effective technique for eliminating global orbit distortion in storage rings resulting from inevitable magnetic field errors distributed around the ring. The their knowledge, this approach has not previously been applied dynamically to eliminate orbit fluctuations arising from time varying magnetic field errors. They have developed a harmonic feedback system which is implemented on a real time basis using relatively simple electronics. The Fourier analysis is done by a simple linear analog network. The input voltages are proportional to the orbit displacements at the detectors, and in real time the output voltages are proportional to the desired Fourier harmonic coefficients. The feedback does not force the displacement to be zero at the detectors, but forces the coefficients of a few harmonics nearest the betatron tune to vanish.

19249 (BNL–46615, pp. 58-68) **Local orbit feedback.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288–1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

Critically aligned experiments are sensitive to small changes in the electron beam orbit. At the NSLS storage rings, the electron beam and photon beam motions have been monitored over the past several years. In the survey conducted in 1986 by the NSLS Users Executive Committee, experimenters requested the vertical beam position variation and the vertical angle variation, within a given fill, remain within 10 μm and 10 μr, respectively. This requires improvement in the beam stability by about one order of magnitude. At the NSLS and SSRL storage rings, the beam that is originally centered on the position monitor by a dc orbit correction is observed to have two kinds of motion: a dc drift over a storage period of several hours and a beam bounce about its nominal position. These motions are a result of the equilibrium orbit not being held perfectly stable due to time-varying errors introduced into the magnetic guide field by power supplies, mechanical vibration of the magnets, cooling water temperature variations, etc. The approach to orbit stabilization includes (1) identifying and suppressing as many noise sources on the machine as possible, (2) correcting the beam position globally (see Section 6) by controlling a number of correctors around the circumference of the machine, and (3) correcting the beam position and angle at a given source location by position feedback using local detectors and local orbit bumps. The third approach, called Local Orbit Feedback will be discussed in this section.

19250 (BNL–46615, pp. 69-76) **Active interlock system for high power insertion devices in the x-ray ring.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288–1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

In modern synchrotron radiation rings photon beams generated by high power insertion devices (IDs) may be sufficiently intense to cause severe thermal damage to the machine vacuum chamber if mis-steered. Thus when operating a storage ring with the IDs, great care must be exercised to prevent mis-steering of the electron beam orbit. At present, the X-ray ring operates with three IDs, namely two hybrid wigglers (HBW) at X-21 and X-25,a nd a 5-Tesla superconducting wiggler at X-17. All wigglers are located in low-beta straight sections. In the straight sections. In the straight sections, beam orbit may be deflected by as much as ±8 mrad without scraping the chamber wall. For various reasons it was not possible to design the X-ray ring vacuum chamber to be safe under all possible operating conditions, however, the chamber is safe for $i < 7$ mA, all horizontal beam deflection angles and for vertical angles $< \pm 2.5$ mrad. To protect the machine vacuum chamber from damage due to mis-steered beams, and interlock system has been developed and installed. This system utilizes active beam position detectors which continuously monitor beam motion in each of the ID straight sections and logic circuitry which interrupts the RF and dumps the stored beam in the case of a fault.

19251 (BNL–46615, pp. 77-85) **Bunch lengthening cavity for the VUV ring.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288–1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

The electron beam lifetime in the VUV Ring is limited by the loss of electrons due to intrabunch (Touschek) scattering. The loss rate due to the Touschek effect is proportional to the electron bunch density. Hence, in order to increase the beam lifetime one must reduce the bunch density. On the other hand, a key design feature of the VUV Ring is the achievement of high brightness of the photon sources by having an electron beam with small transverse beam dimensions. Therefore, to increase the beam lifetime without reducing the source brightness the authors have been led to the use of a fourth-harmonic RF cavity to increase the bunch length.

19252 (BNL–46615, pp. 86-95) **SXLS storage ring design.** Brookhaven National Lab., Upton, NY (United States). Sep 1991. (CONF-8908288–1: United States Particle Accelerator School, Upton, NY (United States), Aug 1989). In *Storage ring development at the National Synchrotron Light Source.* 98p. Order Number DE92002064. Source: OSTI; NTIS; INIS.

X-ray lithography has emerged as a strong candidate to meet the demands of ever finer linewidths on integrated circuits, particularly for linewidths less than .25 microns. Proximity printing X-ray lithography makes use of soft X-rays to shadow print an image of a mask onto a semiconductor wafer to produce integrated circuits. To generate the required X-rays in sufficient quantities to make commercial production viable, electron storage rings have been proposed as the soft X-ray sources. Existing storage rings have been used to do the initial development work and the success of these efforts has led the lithographers to request that new rings be constructed that are dedicated to X-ray lithography. As a result of a series of workshops held at BNL [10.3] which were attended by both semiconductor and accelerator scientists, the following set of zeroth order specifications' on the light and electron beam of a storage ring for X-ray lithography were developed: critical wavelength of light: $\lambda_c = 6$ to 10 angstroms, white light power: $P = 0.25$ to 2.5 watts/mrad, horizontal collection angle per port: $\theta = 10$ to 50 mrad, electron beam sizes: $\sigma_x \approx \sigma_y < 1$ mm, electron beam vertical angular spread $\sigma_y{}' < 1$ mrad.

19253 (BNL–47356) **Conceptual design study of an intense x-ray source for coronary angiography.** Blumberg, L.N. Brookhaven National Lab., Upton, NY (United States). Mar 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92013011. Source: OSTI; NTIS; GPO Dep.

Calculations are presented for several 1.4 GeV electron storage ring designs which, with an ultra-high field (80 kG) superconducting wiggler magnet and beam current $I = 400$ mA, will generate a 33.16 keV x-ray beam at 20 m from the wiggler of adequate intensity (6 10^9/mm^{-2} sec^{-1}) and areal size for iodine K-edge coronary dichromography in humans.

19254 (DESY–91-146) **A Fokker-Planck treatment of stochastic particle motion within the framework of a fully coupled 6-dimensional formalism for electron-positron storage rings including classical spin motion in linear approximation.** Barber, D.P.; Heinemann, K.; Mais, H.; Ripken, G. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 85p. Order Number DE92516977. Source: OSTI; NTIS (US Sales Only); INIS.

In the following report we investigate stochastic particle motion in electron-positron storage ring in the framework of a Fokker-Planck treatment. The motion is described by using the canonical variables χ, p_χ, z, p_z, $\sigma = s - cxt$, $p_\sigma = \Delta E/E_0$ of the fully six-dimensional formalism. Thus synchrotron- and betatron-oscillations are treated simultaneously taking into account all kinds of coupling (synchro-betatron coupling and the coupling of the betatron oscillations by skew quadrupoles and solenoids). In order to set up the Fokker-Planck equation, action-angle variables of the linear coupled motion are introduced. The averaged dimensions of the bunch, resulting from radiation damping of the synchro-betatron oscillations and from an excitation of these oscillations by quantum fluctuations, are calculated by solving the Fokker-Planck equation. The surfaces of constant density in the six-dimensional phase space, given by six-dimensional ellipsoids, are determined. It is shown that the motion of such an ellipsoid under the influence of external fields can be described by six generating orbit vectors which may be combined into a six-dimenional matrix B(s). This 'bunch-shape matrix', B(s), contains complete information about the configuration of the bunch. Classical spin diffusion in linear approximation has also been included so that the dependence of the polarization vector on the orbital phase space coordinates can be studied and another derivation of the linearized depolarization time obtained. (orig.).

19255 (GSI–91-37) **The theory of Schottky spectra of ordered ion beams in a storage ring.** Avilov, V.V.; Hofmann, I. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 40p. Order Number DE92785038. Source: OSTI; NTIS (US Sales Only).

The longitudinal Schottky spectrum of an ultra-cold ion beam in a storage ring is calculated in the frame of harmonic oscillations of a 1d Coulomb lattice. It is assumed that the extremely high cooling rate required to bring the beam into a one-dimensional ordered chain can be provided by electron or laser cooling. The anharmonic transversal oscillations with temperature much higher then the longitudinal one are taken into account within the self-consistent phonon approximation. The Schottky spectrum measured by the pick-up system consists of bands located near the harmonics of the revolution frequency of the beam. The total intensity of each band characterizes the temperature distribution of the phonons in an ionic chain. The amplitude and the width of the peaks in the spectrum are a function of the strength of relaxation processes (cooling and heating) as well as the Coulomb correlations, rsp. ordering. It is suggested that a careful analysis of these spectra could be a signature of the presence of 1d ordering in the beam. (orig.).

19256 (IFVE–91-80) **Design-technical peculiarities of a small-sized equipment for the production of SC transposed cable for the UNK.** Borisov, E.R.; Surkov, A.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 14p. (In Russian). Order Number DE92626839. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the journal Ehlektrotekhnika.

Technological grounds for designing a small-sized transposing equipment, which produces transposed wires of high critical and technological characteristics are given. The design of the equipment based on the proposed approaches has been worked out. Two devices of this type have been manufactured and put into operation. They are considerably advantageous as compared with their analogue worked out in Belgium for SSC. 6 refs.; 7 figs.; 2 tabs.

19257 (IHEP-OEF–91-149) **3 Tev UNK as a kaon and antiproton factory for hadron spectroscopy.** Garkusha, V.I.; Kartashev, V.P.; Kotov, V.I.; Prokoshkin, Yu.D.; Yushchenko, O.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 3p. Order Number DE92626840. Source: OSTI; NTIS (US Sales Only); INIS.

Low-energy high intensity pure kaon and antiproton beams, available at the 3 TeV UNK, are discussed. 4 refs.; 1 fig.

19258 (INFN-LNF–90-019(R)) **Proposal of measuring the mechanisms of nuclear excitation leading to fission with the ADONE jet-target tagged photon beam.** Lucherini, V. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Bianchi, N.; De Sanctis, E.; Guaraldo, C.; Levi Sandri, P.; Muccifora, V.; Polli, E.; Reolon, A.R.; Rossi, P.; Aiello, S.; De Filippo, E.; Lanzano', G.; LoIstituto Nazionale di Fisica Nucleare, Rome (Italy). 1990. 16p. Order Number DE92626841. Source: OSTI; NTIS (US Sales Only); INIS.

22refs.

The mechanisms of excitation with subsequent fission of heavy nuclei can be conveniently studied by means of photons, since this probe is able to interact deeply inside the nucleus. We propose the use of the (200-1200 MeV) tagged photon beam from the ADONE Jet Target in order to study the mass-energy and total momentum distributions of fission fragments, to obtain experimental information on the configurations (excitation energy and nucleonic composition) of produced compound nuclei and on their decay channels.

19259 (INFN-LNF–91-031(R)) **Chromaticity.** Guiducci, S. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 15p. Order Number DE92626842. Source: OSTI; NTIS (US Sales Only); INIS.

A simple calculation of the contribution of quadrupoles and sextupoles to storage ring chromaticity is given. Problems arising from chromaticity carrection are discussed. An accurate derivation of chromaticity formulae for a general bending magnet, exact also for small machines with small radius of curvature, is given.

19260 (INFN-TC–91-08) **A complete stochastic description of internal targets effects on electron rings.** Taiuti, M. (Istituto Nazionale di Fisica Nucleare, Genoa (Italy)); Costa, C.; Anghinolfi, M.; Corvisiero, P.; Ricco, G.; Ripani, M.; Zucchiatti, A.; Muccifora, V.; Bianchi, N.; De sanctis, E.; Levisandri, P.; Lucherini, V.; Polli, E.; Gervino, G.; Mokeev,.Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 21p. Order Number DE92628179. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of internal targets on the beam accumulated in electron storage rings are studied with a linear stochastic model which describes the beam emittance and the beam phase space growth and provides simple formulae for the longitudinal and transverse beam emittance. The description of facilities with and without beam damping is carried out in a consistent way. The obtained results are comparable to those obtained with other models and numerical simulations.

19261 (SLAC–378, pp. 35-95) **Future possibilities for LEP.** Treille, D. (CERN, Geneva (Switzerland)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

To go beyond the LEP 1 program, one can (1) increase the c.m. energy; (2) increase the luminosity, an option technically related to the previous one; (3) increase the sensitivity to possible deviations from the Standard Model by polarizing the beams. These upgrades open up the way to many possibilities for physics concerning accurate measurements as well as searches for the new effects. They also require, from the theoretical and experimental points of view, several improvements and changes. These various topics and their interrelatedness are reviewed and discussed.

19262 (SLAC–378, pp. 239-257) **B-factory storage ring design.** Rees, J.R. (Stanford Univ., CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

In the past few years a good deal of enthusiasm has arisen in the US, Europe and Asia for B-Factories. In these machines electrons and positrons are collided with center-of-mass energies at or near the Y(4s) resonance, with unprecedented high luminosities, to produce copious fluxes of B-mesons. The object is to make high-precision studies of the CP non-conserving B decays. Various colliding-beam configurations have been suggested including both linear colliders and storage rings, but one scheme has emerged as generally preferable to the others. It is the asymmetric storage ring system-asymmetric in the sense that the two beam energies are markedly different and the center of mass is moving in the direction of the higher energy beam. With this arrangement the decaying B-mesons fly off from the interaction region in the same direction, and the time-order of their decays can be deduced from the locations of their decay vertices. These B-Factories present the accelerator builder with two main challenges: to achieve luminosity far beyond that attained in existing storage rings and to do it in the unexplored arena of unequal beam energies. Fortunately the means of meeting these challenges appear to be in hand on the basis of the present understanding of the accelerator physics of colliding-beam storage rings. The problems have been studied in several laboratories in Europe, Japan, the US and the USSR, and the solutions devised in those studies have converged in their general features. A B-Factory will consist of two separate storage rings with a common collision region; each ring will carry what it, by today's standards, high circulating beam currents, and as a consequence, the vacuum chambers will be very well-cooled and strongly vacuum-pumped; and mechanical designs of the interaction regions will be quite complicated, but also quite feasible.

44 INSTRUMENTATION

Refer also to citation(s) 19143

4401 Radiation Instrumentation

Refer also to citation(s) 18401, 18901, 18947, 19145, 19211, 19225, 19355, 19368, 19373, 19402, 19414, 19423, 19434, 19484, 19504, 19505, 19968, 19988, 20132, 20133, 20249, 20333, 20345, 20414, 20423, 20451, 20454, 20551, 20566, 20568

19263 (AECB-C–117) **Requirements for gamma radiation survey meter calibration: Proposed regulatory guide.** Atomic Energy Control Board, Ottawa, ON (Canada). 28 Nov 1990. 26p. (In English, French). Order Number DE92626968. Source: OSTI; NTIS (US Sales Only); INIS.

This guide describes the minimum requirements for calibrating a portable analog gamma radiation survey meter by means of a beam calibrator, with a known calibration source. If an alternative method of calibration is to be used the licensee should make a written request to the Atomic Energy Control Board that describes the calibration method to be used, and request the Board's permission to use that method in place of the requirements contained in this guide. This guide explains: the responsibility for survey meter calibration if licensees calibrate their own survey meters, use the services of a Canadian calibration agency, and use the services of a non-Canadian calibration agency; the requirements for survey meter calibration and the supporting documentation; the requirements for record-keeping; and, a calibration certificate, a calibration sticker, and a notification of failure to calibrate form, with examples.

19264 (AECL–9433) **The Sudbury neutrino observatory.** McLatchie, W. (Queen's Univ., Kingston, ON (Canada)); Earle, E.D. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Apr 1987. 13p. (CONF-8704405–: 12. Science teachers seminar, Chalk River (Canada), 2-4 Apr 1987; SNO–87-5.). Order Number DE92626994. Source: OSTI; NTIS (US Sales Only); INIS.

A group of Canadian scientists, in collaboration with colleagues from the United States and England, proposes to establish a world class laboratory in INCO's Creighton Mine. The laboratory would be dedicated to the study of neutrinos from the sun and other astrophysical objects to advance our understanding of the physical processes which govern the properties of stars, as well as our understanding of the fundamental properties of matter. The laboratory would capitalize on two unique Canadian resources, i.e. access to one of the deepest mines in the western hemisphere and Canada's temporary surplus of heavy water.

19265 (ANL-HEP-CP–90-33) **Rad-hard electronics development program for SSC liquid-argon calorimeters.** Stevens, A. (Argonne National Lab., IL (USA). High Energy Physics Div.); Dawson, J.; Kraner, H.; Radeka, V.; Rescia, S. Argonne National Lab., IL (United States). High Energy Physics Div. [1990]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;AC02-76CH00016. (BNL–45624;CONF-900348–6: 2. international industrialization symposium on the super collider (IISSC), Miami, FL (United States), 14-16 Mar 1990). Order Number DE90011107. Source: OSTI; NTIS; INIS; GPO Dep.

The development program for radiation-hard low-noise low-power front-end electronics for SSC calorimetry is described. Radiation doses of up to 20 MRad and neutron fluences of 10^{14} neutrons/cm^2 are expected over ten years of operation. These effects are simulated by exposing JFETs to neutrons and ionizing radiation and measuring the resulting bias, leakage current and noise variations. In the case of liquid-argon calorimeters, a large part of the front-end circuitry may be located directly within the low-temperature environment (90 K), placing additional constraints on the choice of components and on the design. This approach minimizes the noise and the response time. The radiation damage test facilities at Argonne will also be described. These include sources of neutrons, electrons, and gamma radiation. 8 refs., 9 figs.

19266 (ANL-HEP-CP–90-88) **Simulation studies for design optimisation of a scintillator plate calorimeter.** F. Proudfoot, J. (Argonne National Lab., IL (USA)); Job, P.K.; Trost, H.J.; Handler, T.; Gabriel, T. Oak Ridge National Lab., TN (United States). [1990]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;W-31109-ENG-38 ;FG05-91ER40627. (CONF-9010212–23: Symposium on detector research and development for the Superconducting Super Collider, Fort Worth, TX (United States), 15-18 Oct 1990). Order Number DE91004768. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Results on simulations studies relating to the optimisation of a sampling scintillator plate calorimeter for an SSC detector system are presented. These studies show that whereas a compensating sampling geometry can be obtained using a variety of configurations using either lead or depleted uranium as the principal absorber, no configuration based on a pure iron absorber is compensating. Unlike in a lead system, delayed energy release from long lived shower products produced in a uranium system pose a serious pile up problem. Therefore we advocate the use of lead as the principal absorber in this calorimeter. Work on optimisation of the mechanical structure is in progress and results are presented on issues such as structural support, tolerances and on the degradation in response due to other detector material within the volume of the calorimeter. 8 refs., 16 figs.

19267 (ANL-HEP-CP–92-13) **Mechanical design and finite element analysis of the SDC central calorimeter.** Guarino, V. (Argonne National Lab., IL (United States). High Energy Physics Div.); Hill, N.F.; Nasiatka, J.; Hoecker, D.A.; Hordubay, T.D. Scherbarth, D.W.; Swensrud, R.L. Argonne National Lab., IL (United States). High Energy Physics Div. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920331–2: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE92011197. Source: OSTI; NTIS; INIS; GPO Dep.

When designing scintillating calorimeters for the study of particle interactions resulting from colliding beams, a primary goal is to instrument 100% of the available solid angle. In pursuit of this goal the challenge for mechanical designers is to minimize the amount of structural mass and still maintain acceptable engineering standards in the design. Argonne National Laboratory, High Energy Physics involvement in the design of a central calorimeter for the SSC started in 1989. Our first proposal was to design a depleted uranium scintillator calorimeter similar to the ZEUS detector presently installed at the HERA electron-proton collider in Hamburg, Germany. Argonne was involved at the time in final assembly of modules for ZEUS that had been designed and constructed at ANL. Due to the cost of using depleted uranium, lead was chosen as the absorber material. In collaboration with Westinghouse Science and Technology Center in Pittsburgh, Pennsylvania was embarked on a program to optimize the use of lead or lead alloys in the construction of the calorimeter. A cast lead design for the calorimeter evolved from this effort. Subsequent to this design, further pressure to reduce costs have now dictated a design which contains lead only in the electromagnetic sections of the calorimeter. The finite element analysis we will present here was done using lead for the HAD1 section of the barrel.

19268 (ANL/HEP/TR–92/06) **On the "massless gap" adjustment of detected energy for passive material in front of a calorimeter.** Trost, H.J. Argonne National Lab., IL (United States). High Energy Physics Div. 31 Jan 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (SDC–92-187). Order Number DE92011210. Source: OSTI; NTIS; GPO Dep.

I have designed a correction scheme for energy losses in passive material in front of a calorimeter based on the "massless gap" idea. I use a flexible geometry model of a calorimeter design for SDC outside of a solenoidal coil made of aluminium cylinders of adjustable thickness. The signal from the first radiation length of active calorimetry is scaled dependent on the incoming and observed energies of the shower. A reasonable recovery of the resolution of an unobstructed calorimeter is achieved using correction factors that depend only upon the total thickness of passive material. Thus a useful correction may be built into the hardware by increasing the amount of scintillator in the first radiation length of the active calorimeter. The distribution of correction factors determined event-by-event indicate that an additional dependence on the observed signal in the massless gap and total incident energy is clearly present.

19269 (BARC–1991/E/015) **Development of neutron well coincidence counters for plutonium assay and neutron multiplicity studies.** Dange, S.P. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Datta, T.; Samuel, J.K.; Satya Prakash; Kapoor, S.C.; Vijayan, K.; Dhumwad, R.K. Bhabha Atomic Research Centre, Bombay (India). 1991. 62p. Order Number DE92627003. Source: OSTI; NTIS (US Sales Only); INIS.

The present report describes the fabrication, standardisation and performance evaluation of Neutron Well Coincidence Counters (NWCC) for estimation of plutonium upto Kg level in sealed containments, in finished products of various configurations as well as for neutron multiplicity measurements. The method is based on estimation of even-even plutonium isotopes from coincidence counting of spontaneous fission neutrons using an array of neutron counters in a moderator-housing and a shift-register coincidence logic followed by evaluation of total plutonium content on the basis of known isotopic composition after correction for self multiplication (if any). The method involves use of absolute efficiencies for total and coincidence (fission) neutrons without requiring the repeated calibration procedures for neutron response as a function of plutonium content that depend, in turn, on isotopic composition of plutonium and sample nature. The operating conditions have been optimised after finding experimentally the systems dieaway times and their dependence on the time gatewidth and neutron multiplicity. The range of applicability has been tested by counting several standards sets of PuO_2 samples. Salient features of the NWCC units developed and in regular use are also compared in this report. (author). 14 refs., 9 figs., 15 tabs.

19270 (BNL–47420) **Free ion yields in liquids: Molecular structure and track effects.** Holroyd, R. Brookhaven National Lab., Upton, NY (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920480–1: International conference on liquid radiation detectors: their fundamental properties and applications, Tokyo (Japan), 7-10 Apr 1992). Order Number DE92012208. Source: OSTI; NTIS; INIS; GPO Dep.

The signal generated in a liquid-filled ionization chamber is proporational to the ions that escape, the free ion yield or, G_{fi}. Recent results show how molecular structure, rate of energy loss (dE/dx) and pressure affect G_{fi} and give further insight into the ionization process in liquids. As a consequence of the passage of high energy charged particles through a liquid, molecules are ionized and excited. The electrons have kinetic energy initially which allow them to travel some distance away from their geminate cations. The electrons may lose energy to vibrational modes but a significant fraction of the separation occurs while the electrons have subvibrational (near thermal) energy. When the electron finally thermalizes it is within the coulombic field of its parent cation and the two ions constitute a geminate pair. The free ion yield is determined by the fraction of geminate pairs which separate to form free ions as against those that recombine to form excited states.

19271 (BONN-IR–91-72) **Implementation of the forward drift chambers into the first trigger stage of the ZEUS experiment.** Biltzinger, J. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1991. 136p. (In German). Order Number DE92511567. Source: OSTI; NTIS (US Sales Only); INIS.

The ZEUS-detector at the electron-proton-collider HERA at DESY in Hamburg is equipped with a three-stage trigger system in order to separate electron-proton-collisions from background events. This paper investigates the rates and properties of the most important sources of background. Interactions of beam protons with the rest gas in the beam pipe cause an activity of 14 kHz in the detector, and interactions of the halo protons with the machine elements contribute an estimated rate of 45 kHz. The major topic of this paper is the integration of the Forward Tracking Devices into the First Level Trigger. The triggers of the Forward and Central Tracking Devices are combined to form the Regional First Level Trigger Box, which in turn is integrated in the Global First Level Trigger Box to perform the final first level trigger decision based on information from the inner tracking, calorimeter, myon chambers, and some veto components. Deep inelastic scattering events with a four-momentum transfer of more than 100 GeV^2/c^2 are recognized very efficiently by a calorimeter stand-alone trigger. On the other hand the inner tracking chambers turn out to be essentially to achieve a high efficiency for photoproduction events. (orig.).

19272 (BONN-IR–92-02) **The central drift chamber of the SAPHIR detector - implementation into the experiment and study of its properties.** Haas, K.M. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jan 1992. 136p. (In German). Order Number DE92517030. Source: OSTI; NTIS (US Sales Only); INIS.

At the Bonn accelerator facility ELSA the large solid angle detector SAPHIR was built for the investigation of photon induced reactions. A main component of SAPHIR is the central drift chamber (CDC) matching the magneto gap of $1m^3$. The diameter of the in total 1828 hexagonal drift cells is about 18 mm. The subject of this paper is the implementation of the CDC in the experiment. After the description of the hardware follows the presentation of the software tools for filtering and monitoring the data, which have been developed and tested. An algorithm for extracting the space time relationship is presented. The properties of the chamber with an improved gas mixture (Helium/Neon/Isobutane8 21.25:63.75:15) have been investigated. A spatial resolution of about 200 μm was achieved. The efficiency of the chamber is 97% at a tagged photon of $5x10^4$ per second crossing the chamber. (orig.).

19273 (BONN-IR–92-03) **Development of a FASTBUS data acquisition system for the SAPHIR calorimeter.** Klein, F.J. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jan 1992. 78p. (In German). Order Number DE92511566. Source: OSTI; NTIS (US Sales Only); INIS.

Due to the high duty cycle of the new Electron Accelerator at the Physics Institute of Bonn University, ELSA, experiments with tagged photon beams and a large angular acceptance become possible. The new magnetic detector SAPHIR is layed out to detect multi-particle final states with good accuracy, especially a good photon detection capability is designed. Therefore a large electromagnetic calorimeter is built, consisting of 98 modules covering a detection area of about 16 m^2 in forward direction. For this calorimeter a brass-gas-sandwich detector was developed with signal wires perpendicular to the converter planes. The chambers are filled with a standard gas mixture $Ar/CH_4(90:10)$ at atmospheric pressure and operated with a considerably high voltage in the semi-proportional mode. A modified shower counter module, containing 20 μm thick signal wires, was tested at the electron test beam of the Bonn 2.5 GeV electron synchrotron. An energy resolution of $\sigma(E)/E^{*}\sqrt{E(GeV)} = 12.2\pm0.5\%$ was achieved. For data acquisition a modular FASTBUS system was used, which will be installed in the SAPHIR Online Program. (orig.).

19274 (DOE/ER/40125–32) **Central and forward tracking collaboration: Progress report for FY 1991.** Foster, R. (Indiana Univ., Bloomington, IN (United States)); Hanson, G.; Luehring, F.; Luo, X.; Martin, B.; Ogren, H.; Rust, D.R.; Wente, E.; Adrian, B.; Alexander, D.; Ells, F.; Erdos, E.; Ford, W.T.; Johnson, D.; Lohner, M.; Rankin, P.; Schultz, G.; NewcIndiana Univ., Bloomington, IN (United States). 13 Sep 1991. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-84ER40125. Order Number DE92010796. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this subsystem R&D project is to carry out a detailed study and design of a complete wire chamber tracking system covering pseudorapidity $|\eta| \leq 2.5$ in a solenoidal detector for the SSC. Most of our group are now part of the Solenoidal Detector Collaboration (SDC), so the work has evolved into developing a tracking system conceptual design for the SDC detector. The design discussed in this report uses straw tube drift chambers for the central tracking region. Because of the high rates in the SSC environment, a small cell design is needed for wire chambers in the central region. Straw tubes as small cells offer many advantages because the sense wire is enclosed in a continuous cathode, and the wire tension due to the sense wire only can be supported without a massive structure. The straw tubes are grouped together to form superlayers in order to provide local track segments. The superlayers are composed of modules consisting of about two hundred straw tubes enclosed in a carbon fiber composite shell. Straw tubes have been used in previous experiments for small vertex drift chambers. However, they have never before been used for a large tracking system.

19275 (DOE/ER/40171–4) **Proposal to the Department of Energy for participation in the UA1 experiment.** Rohlf, J.W. Harvard Univ., Cambridge, MA (United States). High Energy Physics Lab. Feb 1988. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER40171. Order Number DE92013499. Source: OSTI; NTIS; INIS; GPO Dep.

This proposal is to the Department of Energy for 501.6K dollars (349.6K operations and 152K equipment) for continued participation in the UA1 experiment on proton-antiproton collisions. The UA1 experiment is the study of high-energy proton-antiproton collisions in the Super-Proton-synchrotron (SPS) Collider at CERN. A major upgrade of the UA1 detector is in progress for operation with the upgraded antiproton source (ACOL). The US groups have played an increasingly prominent role in UA1 during the past few years. This paper discusses the data analysis that has been done by the group of the position detector and it's hardware.

19276 (DOE/ER/40452–6) **Particle detection using superfluid helium.** Bandler, S.R.; Lanou, R.E.; Maris, H.J.; More, T.; Porter, F.S.; Seidel, G.M.; Torii, R. Brown Univ., Providence, RI (United States). Dept. of Physics. [1991]. 13p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-88ER40452. (CONF-9109357–1: 6. international workshop on low temperature particle detectors, Oxford (United Kingdom), 5 Sep 1991). Order Number DE92011603. Source: OSTI; NTIS; GPO Dep.

We have observed 5 MeV α particles stopped in volumes-up to two liters of liquid helium at 70 mK. A fraction of the kinetic energy of an α particle is converted to elementary excitations (rotons and phonons), which progagate ballistically in isotopically pure ^{4}He below 0.1 K. Most of these excitations have sufficient energy to evaporate helium atoms on hitting a free surface. The evaporated helium atoms can be detected calorimetrically when adsorbed on a thin silicon wafer ($\sim$1.7 g, 35 cm^{2}) suspended above the liquid. Temperature changes of the silicon are measured with a NTD germanium bolometer. For the geometry studied the observed temperature change of the silicon resulting from an α event in the liquid is approximately 5% of the temperature rise from an α hitting the silicon directly. The implications of these measurements will be discussed as they relate to the possible construction of a large scale detector of solar neutrinos.

19277 (DOE/ER/40670–1) **The Solenoidal Detector Collaboration at the SSCL: Progress report, March 1, 1991–February 29, 1992.** Maryland Univ., College Park, MD (United States). Dept. of Physics and Astronomy. [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER40670. Order Number DE92011941. Source: OSTI; NTIS; INIS; GPO Dep.

Our primary interest is the detection and measurement of muons and the design of the muon detector and trigger for the SDC. We have been concentrating on the design of the forward muon system (in the approximate pseudo-rapidity region of $1.5 <| \eta |<2.5$ corresponding to azimuthal angles of 9.4° to 26. 0°) and at present are responsible for the engineering design of the detector support system in this rapidity region. We are also participating in the development of a liquid argon (LAr) calorimeter adapted to the bunch structure of the SSC machine. At present a LAr calorimeter still remains an option for the choice of calorimetry for the SDC. Recent measurements at BNL in a 20 GeV pion beam confirm that many of the problems associated with long signal collection times of LAr can be solved.

19278 (EGG–10617-3008) **Current status of the associated particle imaging system at STL.** EG and G Energy Measurements, Inc., Las Vegas, NV (United States); Special Technologies Lab., Santa Barbara, CA (United States). 10 Jan 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE92011448. Source: OSTI; NTIS; GPO Dep.

This report describes the activities of the Special Technologies Laboratory in developing the technology of associated particle imaging (API). This work has been carried out under the Special Technologies Program of the US DOE Office of Threat Assessment. The report describes the design, development, and fabrication of a small, portable neutron source, the sealed tube neutron generator (STNG), including composition of the software used in the design of the STNG electrodes; the specification, selection, assembly, and testing of the complex data acquisition and logic circuitry; and composition of the extensive software necessary to analyze and compile the copious data, and display them into moving, multi-dimensional images. 20 refs.

19279 (FNAL/C–92/63) **Ideas for a long-baseline neutrino detector.** Bernstein, R. Fermi National Accelerator Lab., Batavia, IL (United States). Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9111141–5: Workshop on long-baseline neutrino oscillations, Batavia, IL (United States), 17-20 Nov 1991). Order Number DE92010650. Source: OSTI; NTIS; INIS; GPO Dep.

The Atmospheric Neutrino Deficit defines a region in Δm^{2}-$\sin^{2}2\theta$ space which ought to be conclusively tested in a long-baseline experiment. This talk sets out a region to cover (which may change as more data is analyzed) and translates that region into an L/E. I present exclusion curves for different experiments based on their distance and their precision; I conclude that an experiment which can detect oscillations down to 1% located at 1200 km will cleanly test the allowed region from Kamioka and IMB. I then describe the techniques which can perform such a measurement and outline both a detector capable of performing such an experiment and some of the systematic problems we might expect.

19280 (FNAL/C–92/66) **Operation and radiation resistance of a FOXFET biasing structure for silicon strip detectors.** Laakso, M. (Fermi National Accelerator Lab., Batavia, IL (United States)); Singh, P.; Engels, E. Jr.; Shepard, P. Fermi National Accelerator Lab., Batavia, IL (United States). Feb 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920299–1: 6. European symposium on semiconductor detectors, Milano (Italy), 24-27 Feb 1992). Order Number DE92011279. Source: OSTI; NTIS; INIS; GPO Dep.

AC-coupled strip detectors biased with a FOXFET transistor structure have been studied. Measurement results for the basic operational characteristics of the FOXFET are presented together with a brief description of the physics underlying its operation. Radiation effects were studied using photons from a ^{137}Cs source. Changes in the FOXFET characteristics as a function of radiation dose up to 1 MRad are reported. Results about the effect of radiation on the noise from a FOXFET biased detector are described. 13 refs.

19281 (FNAL-TM–1770) **Prototype SDC Muon alignment-position monitoring concepts.** Eartly, D. (Fermi National Accelerator Lab., Batavia, IL (United States)); Johnson, P. Fermi National Accelerator Lab., Batavia, IL (United States). 16 Mar 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE92013594. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed and tested some prototype ideas, components, and systems for monitoring the relative planar orientations, spacings between, transverse positions and rotations of the multi Muon supermodule layers in a given SDC Muon chamber projective tower. These are described and parameterized from measurements. Their resolutions are given, and long term stabilities have been determined.

19282 (GKSS–91/E/65) **The feasibility of using a Fourier RTOF spectrometer at a low-power research reactor.** Maayouf, R.M.A. (Nuclear Research Center, Atomic Energy Authority, Cairo (Egypt). Reactor and Neutron Physics Dept.); Priesmeyer, H.G.; Kudryashev, V.A. GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany). 1991. 25p. Order Number DE92516930. Source: OSTI; NTIS (US Sales Only); INIS.

The present situation of Fourier time-of-flight (TOF) spectrometry is discussed using the FSS spectrometer as example. The use of the Fourier reverse TOF spectrometry, as an efficient tool for studying condensed matter, at a 2 MW (WWR-S type) reactor is also assessed. The arrangement of the RTOF spectrometer, which could be successfully used at such type of reactor, is introduced. The suggested arrangement applies a neutron guide tube of 24 m length and allows for effective luminosity $2.4.10^6$ at a flight path distance of 3.6 m. The number of neutrons scattered from a sample (5 cm^3 in volume) and incident on the detector system, as estimated for the suggested arrangement, is $\propto 1.6.10^3$ n/sec. Such high counting rate allows to measure a diffraction spectrum within less than an hour. (orig.) With 12 figs.

19283 (GKSS–91/E/82) **High-resolution diffractometer MINI-SFINKS.** Trunov, W.A. (Academy of Sciences, Leningrad (USSR). Inst. of Nuclear Physics); Kudryaschev, W.A.; Uljanov, W.A.; Bulkin, A.P.; Muratov, W.G.; Korotkova, T.K.; Schebetov, A.F.; Hiismaeki, P.; Poeyry, H.; Tiitta, A.; Antson, O.; Mutka, H.; Kukkonen, H. GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany). 1991. 58p. Translated from Russian, originally published as report LINP–1277. (In German). Order Number DE92516929. Source: OSTI; NTIS (US Sales Only); INIS.

The theoretical principles of the RTOF (reverse time-of-flight) method as well as the basic equations, the optimization of the neutron guides with Fourier chopper and the time-focussing detector setup are outlined. The powder diffractometer is described and some experimental results are given. The report was used as conceptual design basis for the FSS spectrometer at FRG-1 (GKSS Research Center) which has been optimized for non-destructive determination of residual stress. (orig.) With 18 figs., 3 tabs.

19284 (GSI–92-05) **Study of the momentum loss achromate and its application to the measurement of the *β*-delayed neutron radioactivity of ^{14}Be, ^{17}B, and ^{19}C.** Hanelt, E. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany); Technische Hochschule Darmstadt (Germany). Fachbereich 5 - Physik. Feb 1992. 182p. (In German). Order Number DE92517027. Source: OSTI; NTIS (US Sales Only); INIS.

In this thesis it was shown that the projectile fragmentation at relativistic projectile velocities is a production mechanism for exotic nuclei, which is because of its advantageous kinematics especially suited for the fast and efficient separation of the reaction product in an ion optical system. An essential result of these studies is that projectile fragments can be separated in a wide energy range from about 100 MeV/nucleon to 1 GeV/nucleon and over the whole mass range by means of a momentum-loss achromate. In the experiment described in this thesis this method was for the first time applied to the measurement of the *β*-deLayed neutron radioactivity. The studied isotopes $^{-}1^{-}4$Be, $^{-}1^{-}7$B, and $^{-}1^{-}9$C were produced by the fragmentation of a $^{-}2^{-}2$Ne beam at 60 MeV/nucleon. A measurement of *β* half-lifes and neutron branching ratios was performed, the accuracy of which was in other experiments with similarly exotic nuclei hitherto hardly reached. In $^{-}1^{-}7$B thereby for the first time a *β*-delayed 4-neutron radioactivity could be detected. The results of these measurements were compared with calculations from different theoretical models. The observed multiplicities of the *β*-delayed neutrons are consistent with the multiplicities, which are expected by means of a comparison of the $Q_{-}\beta$ values and the neutron binding energies. The measured neutron branching ratios yield indirect information on distribution of the *β* strength in the daugther nuclei. At time none of the theories is yet able to reproduce these experimental values in sufficient way. (orig./HSI).

19285 (INFN-LNF–91-061(R)) **High-resolution, low-energy e.m. Pb-SCIFI calorimetry: An investigation on fibres and tests on photon beam with low-energy photons.** Bianco, S. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Casaccia, R.; Daniello, L.; Fabbri, F.L.; Giardoni, M.; Zallo, A.; Lindozzi, M.; Passamonti, L.; Russo, V.; Sarwar, S.; Votano, L.; Mertzog, D.; Hughes, S.; RIstituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 9p. (CONF-9105338–: 5. Meeting on advanced detectors, La Biodola (Italy), 26-31 May 1991). Order Number DE92626995. Source: OSTI; NTIS (US Sales Only); INIS.

This article reports on studies aimed to characterise the properties of plastic scintillating fibres to be used in head-on, 1:1 Pb-SCIFI calorimetric modules. The effect of glue on the attenuation of the light transported by cladding close to the photomultiplier tube is studied and found to effectivaly decrease the contribution of cladding light. Pb-SCIFI modules have been assembled and tested on a 20-80 Mev tagged photon beam. Good linearity and energy resolution better than $6\%/\sqrt{E[GeV]}$ were achieved, therefore showing that this technique is suitable for experimental at *ϕ*-factories.

19286 (INFN-LNF–91-062(R)) **The S.C.I.C. detector: an unconventional design for the detection of low-energy (200-300)MeV photons.** Bianco, S. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Casaccia, R.; Fabbri, F.L.; Giardoni, M.; Passamonti, L.; Russo, V. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 7p. (CONF-9105338–: 5. Meeting on advanced detectors, La Biodola (Italy), 26-31 May 1991). Order Number DE92626996. Source: OSTI; NTIS (US Sales Only); INIS.

The simulated performances of a non-homogeneous e.m. calorimeter based on a 5 X tracking section using CsI(Tl) fibres, followed by a 10 X_0Pb-SCIFI head-on back section are reported. The study shows that such a technique is quite promising for the high-efficiency detection of photons in the energy range of interest at a *ϕ*-factory machine.

19287 (INFN-TC–91-05) **Design of a reflex time-of-flight mass spectrometer for the study of the desorption of molecular ions.** Riggi, F. (Istituto Nazionale di Fisica Nucleare, Catania (Italy)). Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 9p. Order Number DE92626979. Source: OSTI; NTIS (US Sales Only); INIS.

A reflex time-of-flight mass spectrometer for the study of the desorption and dissociation of molecular ions has been designed. A general overview of the instrument is reported, together with the different experimental aspects of the technique. These include mechanical and vacuum solutions, secondary ion optics in the electrostatic mirror, electronics, data acquisition and analysis.

19288 (INIS-BR–2922, pp. 260) **Economy and functionally in radiodiagnostic service.** Freitas, E.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DIAGNOSIS/equipment; DIAGNOSIS/nuclear medicine; DIAGNOSIS/performance; DIAGNOSIS; EQUIPMENT; PERFORMANCE; QUALITY CONTROL

19289 (INIS-mf–13179, pp. 198-208) **Heavy ion reaction analyzer facility (HIRA) at NSC.** Sinha, A.K. (Nuclear Science Centre, New Delhi (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

A recoil mass separator facility HIRA is being set up by the scientists from Nuclear Science Centre (NSC), Delhi and the universities in order to exploit the full potential of the research with the heavy ion beams from the Pelletrons at NSC. It is in an advanced stage of installation. The electromagnetic configuration selected for HIRA is QQEMEQQ. The combination EME of electrostatic (E) and magnetic (M) deflectors is chosen so as to ensure reasonable mass dispersion along with achieving a X-(horizontal displacement) and O (horizontal divergence) focus in energy. In addition to the enhancement in the solid angle of acceptance, the two quadrupole-doublets provide for a lower Y-magnification, a variable mass dispersion and possibility of incorporating suitable higher order fields for correction of some aberrations etc. A multipole magnet is also included before the magnetic dipole to provide for a fine tuning of the HIRA. In some of the experiments planned, it is required to set HIRA at angles different from the normally used zero degree direction. To take care of this, HIRA will be mounted on a rotatable platform and coupled to the beam line with a sliding seal vacuum chamber. (author). 3 refs., 1 tab.

19290 (INIS-mf–13179, pp. 187-197) **SHRI: separator for heavy recoil ions: A recoil mass spectrometer for Bombay pelletron.** Singh, P. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The recoil mass spectrometer, SHRI, designed for use with the 14UD BARC-TIFR Pelletron is now under fabrication. The spectrometer consists of a combination of electric and magnetic fields in QQEBE configuration. The mirror symmetric 3-dipole system allows energy dispersionless focussing on the detector. Maximum attainable electric and magnetic rigidities have been chosen considering the various target-projectile combinations planned for the Pelletron accelerator. The design studies indicate that a mass dispersion of 11 mm/% and mass resolving power of >300 are feasible at a maximum solid angle of 8 msr. The present status of the spectrometer and planned experiments are reviewed. (author). 14 refs., 4 figs., 1 table.

19291 (INIS-mf–13179, pp. 242-258) **Barium fluoride: a new scintillation detector material.** Chougaonkar, M.P. (Bhabha Atomic Research Centre, Bombay (India). Technical Physics and Prototype Engineering Div.); Gokhale, V.H.; Rao, S.M.D.; Srikantiah, R.V. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Barium fluoride exhibits at least two light output components. A fast component appears with low intensity at 220nm with decay constant of 0.6ns, while the slow one appears with comparatively more intensity at 310 nm with a decay constant of 600 ns. This property of the material can be exploited for the measurement of both energy as well as timing spectroscopy. BARC has been actively involved in the growth and characterisation of barium fluoride crystals during past few years. Crystals measuring 40 mm dia and 30 mm long have been grown in the high temperature high vacuum furnace using Bridgmann technique. The crystals grown have been characterised for impurity analyses, UV transmission and gamma ray spectra measurements. Improvement in the transmission in the UV region, scintillation characteristics, are the areas in which the work is being carried out. It is also being planned to shift the scintillation wavelength to the near visible range so that more conventional PMTs can be used. (author). 20 refs., 3 tabs.

19292 (INIS-mf–13179, pp. 231-241) **New trends in the growth of scintillation detector crystals.** Arivuoli, D. (Anna Univ., Madras (India). Crystal Growth Centre); Kumar, J.; Ramaswamy, P. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

A review has been given regarding the growth of different scintillators comprising organic, inorganic and plastic materials. For the scintillator crystal to have high efficiency, it should possess high density, high physical efficiency (fraction of absorbed energy transformed to light should be large), low opacity to its own emission, short decay time and extremely small afterglow. All these factors depend upon the perfection (purity, dislocation) of the crystal and in certain cases, activator concentration. The different crystal growth techniques (like melt, vapour, and solution) adopted are discussed in terms of their impurity content (activator), detection efficiency and spectral resolution. Results on currently used scintillators like BGO and BSO grown both by Czochralski and travelling solvent zone apparatus are presented. The role played by stoichiometry and convective flow during growth is also presented. The advantages of these crystals over other scintillation detectors are discussed. (author). 5 refs., 3 tabs.

19293 (INIS-mf–13179, pp. 221-230) **Gamma detector array facility at Nuclear Science Centre.** Bhowmik, R.K. (Nuclear Science Centre, New Delhi (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

A Gamma Detector Arrays (GDA) facility being set up at the Nuclear Science Centre, Delhi is described. It will be used to study nuclear shapes at high spin, measurement of lifetimes and g-factors of high spin states and study of nuclei far from stability. (author). 6 figs.

19294 (INIS-mf–13179, pp. 209-220) **Gamma ray multiplicity set up at the BARC/TIFR 14UD pelletron accelerator.** Choudhary, R.K. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/Seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Angular momentum plays an important role in the characterisation of heavy ion reaction processes. Gamma ray multiplicity measurements provide a unique method for the determination of the angular momentum of nuclei produced in heavy ion reactions, and have been used to study the angular momentum distributions in different reaction channels such as transfer, deep inelastic and fusion processes, which have helped in a better understanding of the various aspects of the reaction mechanism in heavy ion collisions. A gamma ray multiplicity array at the BARC/TIFR 14UD pelletron, consisting of a number of hexagonal BGO detector elements has been set up. The salient features of the multiplicity set up, the theory of the measurements and the results obtained from the first experiments using this set up are dealt with. (author). 14 refs., 5 figs.

19295 (INIS-mf–13183, pp. 36) **A comparison of the image characteristics of iterative and backprojective tomographic reconstruction techniques by means of receiver-observation characteristic analysis.** Herbst, C.P. (Orange Free State Univ., Bloemfontein (South Africa). Dept. of Biophysics); Naude, H.; Van Aswegen, A.; Loetter, M.G. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (In Afrikaans). (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY/images; BRAIN; COMPARATIVE EVALUATIONS; IMAGES; TECHNETIUM 99

19296 (INIS-mf–13183, pp. 36) **A practical evaluation of the value of a FPASS study combined with a MIBI cardiac study.** Van Ieperen, A.R.; Kiebooms, L.; Drieskens, L.; Noyens, P.; Thys, G. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIOCARDIOGRAPHY/f codes; BIOLOGICAL STRESS; BRAIN; IMAGES; MYOCARDIUM; RADIOCARDIOGRAPHY; SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY

19297 (INIS-mf–13183, pp. 37) **Verification of a varying threshold edge detection SPECT technique on spleen volume: a comparison to CT volumes.** Pretorius, P.H. (Orange Free State Univ., Bloemfontein (South Africa)); Van Aswegen, A.; Loetter, M.G.; Herbst, C.P.; Nel, M.G.; Otto, A.C. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. SPLEEN/cat scanning; SPLEEN/single photon emission computed tomography; ALGORITHMS; CALIBRATION; COMPARATIVE EVALUATIONS; IMAGES; ORGANS; PATIENTS; RADIONUCLIDE KINETICS; REGRESSION ANALYSIS; SPLEEN; VERIFICATION; VOLUME; X RADIATION

19298 (INIS-mf–13183, pp. 45) **Design and performance characteristics of a diamond probe for dosimetry of radiation fields.** Nam, T.L. (Central Health Physics Service, University of the Witwatersrand, Johannesburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. DOSIMETRY/diamonds; DOSIMETRY/probes; DESIGN; DOSIMETRY; DIAMONDS; PROBES; PERFORMANCE; RADIOTHERAPY

19299 (INIS-mf–13183, pp. 45) **Dosimetry based on the photostimulated luminescence of diamond.** Araikum, S. (Central Health Physics Service, University of the Witwatersrand, Johannesburg (South Africa)); Nam, T.L.; Keddy, R.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. DOSIMETRY/diamonds; BETA PARTICLES; DE-EXCITATION; DOSIMETRY; DIAMONDS; GAMMA RADIATION; PHOTOLUMINESCENCE; THERMOLUMINESCENCE

19300 (INIS-mf–13183, pp. 34) **Linearity study on dosimeter readers used at the radiation protection service of the SABS.** Volschenk, Du T. (South African Bureau of Standards (SABS), Pretoria (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. DOSEMETERS/radiation protection; CALIBRATION; DOSEMETERS; DOSIMETRY; MODIFICATIONS; SOUTH AFRICAN ORGANIZATIONS

19301 (INIS-mf–13183, pp. 34) **TLD non-linearity below two gray.** Scott, M.J. (Hillbrow Hospital, Johannesburg (South Africa). Dept. of Medical Physics). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. THERMOLUMINESCENT DOSEMETERS/calibration; ACCURACY; RADIATION DOSE UNITS; RADIATION DOSES; SCATTERING; THERAPY; CALIBRATION

19302 (INIS-mf–13183, pp. 34) **A European proton dosimetry intercomparison.** Jones, D.T.L. (National Accelerator Centre, Faure (South Africa)); Kacperek, A.; Vynckier, S.; Mazal, A.; Delacroix, S.; Nauraye, C. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. PROTON DOSIMETRY/calibration standards; PROTON DOSIMETRY/coordinated research programs; BELGIAN ORGANIZATIONS; BRAGG GRAY CHAMBERS; CALORIMETERS; COBALT 60; DOSEMETERS; EUROPE; FARADAY CUPS; FRENCH ORGANIZATIONS; MEV RANGE 10-100; NAC CYCLOTRON; PROTON BEAMS; STANDARDIZATION; THERAPY; UNITED KINGDOM ORGANIZATIONS

19303 (INIS-mf–13183, pp. 36) **Quality control record of life of Γ-counter's NaI(Tl) crystal.** Rae, W.I.D. (Radiotherapy Department, Provincial Hospital, Cooperskloof (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. NAI DETECTORS/quality control; CALIBRATION; CESIUM 137; RADIATION DETECTORS; RESOLUTION; TITANIUM

19304 (INIS-mf–13183, pp. 46) **Upgrading and verification of national personal dosimetry system.** Volschenk, T. (South African Bureau of Standards (SABS), Pretoria (South Africa)); Mac Curtain, S.; De Oude, A.; Rapley, F. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. DOSIMETRY/verification; ALGORITHMS; CALIBRATION; COMPUTERS; DOSEMETERS; DOSIMETRY; VERIFICATION

19305 (INIS-mf–13183, pp. 38) **Routine monitoring of X-ray unit performance.** Surujhlal, S.N. (Medical Univ. of Southern Africa, Pretoria (South Africa). Dept. of Medical Physics); Jordaan, M.M.; Chamberlain, A.C.; Strydom, W.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. X RADIATION/monitoring; ELECTRIC POTENTIAL; MEDICAL ESTABLISHMENTS; MICROCOMPUTERS; N CODES; PERFORMANCE; QUALITY ASSURANCE; QUALITY CONTROL; RADIATION DOSES; TIME DEPENDENCE; WAVE FORMS; MONITORING

19306 (INIS-mf–13183, pp. 44) **Quantitation of SPECT performance.** Graham, L.S. (American Association of Physicists in Medicine, New York, NY (United States)); Van Aswegen, A.; Madsen, M.T.; Fahey, F.H. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY/quality control; IMAGES; PERFORMANCE; PERFORMANCE TESTING; PHANTOMS; RADIONUCLIDE KINETICS; SPATIAL RESOLUTION

19307 (INIS-mf–13183, pp. 43) **New technique for the construction of compensator filters.** Van Rensburg, A.J. (H.F. Verwoerd Hospital, Pretoria (South Africa)); Fourie, O.L.; Alberts, A.S. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. FILTERS/fabrication; BEAMS; DATA ACQUISITION; FILTERS; FABRICATION; MEASURING INSTRUMENTS; MICROCOMPUTERS; NEOPLASMS; PATIENTS; PHANTOMS; RADIATION DOSES; RADIOTHERAPY; SKIN

19308 (INIS-mf–13192, pp. 246) **Small-angle neutron scattering and its applications.** Michalec, R. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Chalupa, B.; Saroun, J.; Michalcova, B.; Vavra, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NEUTRON SPECTROMETERS; NEUTRONS; SMALL ANGLE SCATTERING; USES

19309 (INIS-mf–13192, pp. 248) **In-beam gamma-ray spectroscopy on the U 120 M cyclotron.** Spalek, A. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Honusek, M.; Adam, J.; Tlusty, P.; Wagner, V.; Zakoucky, D. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GAMMA SPECTROSCOPY/cyclotrons; ALPHA REACTIONS; CYCLOTRONS; NEUTRON REACTIONS; PHOTONUCLEAR REACTIONS; SELENIUM 74 TARGET; SELENIUM 77 TARGET

19310 (INIS-mf–13192, pp. 249) **Neutron production in deuteron-propane interactions at 4.2 GeV/c.** Brhlik, M. (Karlova Univ., Prague (Czechoslovakia)); Dolejsi, J.; Holan, P.; Tas, P.; Trka, Z. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NEUTRON DETECTION/bubble chambers; DEUTERONS; GEV RANGE 01-10; NEUTRON SPECTRA; NEUTRONS; PARTICLE INTERACTIONS; PARTICLE PRODUCTION; PROPANE

19311 (INIS-mf–13192, pp. 241) **Products of TESLA VUPJT Premysleni for your experiments.** Soukup, T. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky); Viererbl, L. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RADIATION DETECTORS; CAMAC SYSTEM

19312 (INIS-mf–13192, pp. 246) **Neutron interferometry at a pulsed source.** Lukas, P. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Kulda, J.; Mikula, P.; Sedlakova, L. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INTERFEROMETRY/pulsed neutron techniques; IBR-2 REACTOR; INTERFEROMETRY; SCATTERING LENGTHS

19313 (INIS-mf–13192, pp. 249) **A position sensitive silicon detector for subnuclear physics.** Pavlu, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska); Sopko, B.; Macha, I. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SI SEMICONDUCTOR DETECTORS/position sensitive detectors

19314 (INIS-SU–308/A, pp. 27-31) **Capabilities of a position-time spectrometer for determining antineutrino rest mass from the ^{3}H beta spectrum.** Babenkov, M.I. (AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki); Zhdanov, V.S. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411-: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

A possibility of improving the background conditions in tritium experiments is considered. An experiment on determining the rest mass of antineutrino from tritium beta spectrum is supposed to be conducted on the position-time spectrometer (PTS) under construction. The experiment scheme is presented. The PTS provides for an energy resolution typical of similar experiments (40-50 eV) at the tritium beta spectrum boundary. 11 refs.; 3 figs.

19315 (INIS-SU–308/A, pp. 32-36) **$\pi\sqrt{2}$ magnetic high-resolution beta spectrometer with a position sensitive detector.** Mitrokhovich, N.F. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Sidorenko, L.P. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411-: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Multichannel methods for measuring electron spectra using a high resolution $\pi\sqrt{2}$ spectrometer (ρ=50 cm), based on applying a position-sensitive detector (PSD) in its focal plane, are described. The position-sensitive system is formed by a chevron assembly of microchannel plates (43x63 mm^2, channel diameter - 10 μm, caliber - 80) together with an electromagnetic delay line, measurement of a position spectrum is realized according to the time method applying the time-amplitude converter and a 256-channel analyser. According to the data obtained, the accuracy of measuring the intensities of lines falling within PSD capture range, makes up 2%. The accuracy of determining the relative intensities of lines remote from each other by the energy is worse, but proceeding from the course of the efficiency curve measured, it does not exceed 5%. 3 refs.; 3 figs.

19316 (INIS-SU–308/A, pp. 37-42) **Multichannel beta spectrometer with a position-sensitive detector based on microchannel plates.** Abdurazakov, A.A. (Tashkentskij Gosudarstvennyj Univ., Tashkent (USSR)); Blinnikov, Yu.S.; Butabaev, Yu.S.; Lebedev, N.A.; Niyazov, R.A.; Pajziev, Sh.D.; Khodzhaev, M.S.; Kholmatov, A.Kh. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

A beta spectrometer with a constant magnetic field is described. To increase the luminosity and sensitivity the detection system is based on microchannel plates (MCP). Application of MCP increases the electron recording efficiency which allows one to use the advantages of a magnetic spectrograph in experiments on-line with mass-separators of the accelerators to study the short-living nucleus internal conversion electron spectra. 3 refs.; 4 figs.

19317 (INIS-SU–308/A, pp. 21-26) **Position-sensitive detectors in charged-particle spectrometry.** Babenkov, M.I. (AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki); Zhdanov, V.S.; Ryzhikh, V.Yu. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Application of position-sensitive detectors in beta-spectroscopy is briefly discussed. Application of three types of detectors is considered: proportional chambers (counters), solid semiconductor counters and detectors with microchannel plates. 12 refs.; 2 figs.

19318 (ISN–91-55) **Beam Cherenkov counter conception for in line identification of 270 GeV/c Σ^- Ξ^- and Ω^-.** Touillon, R. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France). Jun 1991. 170p. (In French). Order Number DE92517865. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this thesis is to design a beam Cerenkov counter. This counter will provide an on line identification of the Σ^-, Ξ^- and Ω^- hyperons (270 GeV/c) in the experiment WA89 at CERN. The acceptance of the detector should allow tagging these hyperons in a large momentum range (± 25%) and for a beam divergence up to 250 microrad. The first part of this report is devoted to the physical goals such as the study of charmed baryons, the search of multiquark states, and the determination of hadronic and electromagnetic hyperon radii. The experimental WA89 setup is also presented. The major part deals with the design of the Cerenkov counter. The dimension of the detector, the Cerenkov angle value, the focal length of the spherical mirror, etc... are derived from a Monte-Carlo simulation. Various methods of simple photon detection (gaz detector: TEA, TMAE; solid detectors: PM and Image Intensifier) are investigated. The most performing solution uses two conical mirrors in order to reduce the size of the Cerenkov circles and an image intensifier (which detects the single photon) followed by an optical fiber matrix transmitting the luminous signal to 160 photomultipliers. The on line procedure for calculating the radius of each circle (identification of the particle) is studied in detail. Finally, the optimization of the optical system to achromatize the Cerenkov light is discussed.

19319 (KEK-PROC–91-8, pp. 61-83) **Search for neutralinos in the Z^0 decay at LEP.** Hidaka, K. (Tokyo Gakugei Univ., Koganei (Japan)); Ratcliffe, P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. (CONF-9008241–: KEK summer institute on high energy phenomenology, Tsukuba (Japan), 21-25 Aug 1990). In *Proceedings of the KEK summer institute on high energy phenomenology.* 145p. Order Number DE92782188. Source: OSTI; NTIS (US Sales Only); INIS.

We investigate neutralino production process $e^- e^+ \to Z^0 \to z_k\ z_{k'}$ at the Z^0 peak. Recent LEP and SLC data on Z^0 decays (such as total and invisible width of Z^0 and unsuccessful searches for chargino pairs and acoplanar charged lepton pairs and jet pairs) and the gluino search experiments at S(p-bar)pS and TEVATRON significantly constrain the mass matrix parameters of chargino and neutralino sectors. We find that despite these constraints there still remains a sizable 'window' in the parameter space really open for discovering neutralinos in the Z^0 decay at LEP. Encouraged by this observation we evaluate the event distributions for the detected particles in this process. The information these can provide would be valuable in identifying this production mechanism and the new particles responsible for it, including their spins, masses and couplings. (author).

19320 (LA–12237-MS) **Capability and limitation study of the DDT passive-active neutron waste assay instrument.** Nicholas, N.J.; Coop, K.L.; Estep, R.J. Los Alamos National Lab., NM (United States). May 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011758. Source: OSTI; NTIS; INIS; GPO Dep.

The differential-dieaway-technique passive-active neutron assay system is widely used by transuranic waste generators to certify their drummed waste for eventual shipment to the Waste Isolation Pilot Plant (WIPP). Stricter criteria being established for waste emplacement at the WIPP site has led to a renewed interest in improvements to and a better understanding of current nondestructive assay (NDA) techniques. Our study includes the effects of source position, extreme matrices, high neutron backgrounds, and source self-shielding to explore the system's capabilities and limitations and to establish a basis for comparison with other NDA systems. 11 refs.

19321 (LA–12277-MS) **Simulation of backscatter imaging.** Atwater, H.F.; Morris, R.A. Los Alamos National Lab., NM (United States). Apr 1992. 9p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92010927. Source: OSTI; NTIS; GPO Dep.

Frequently during remodeling or modifications of existing buildings, it is necessary to know that exact location of various utility lines (such as water or sewer and electrical conduit) before drilling holes in floors and walls. In many cases conventional radiography or metal detectors may be used to map out the lines, but occasionally a one-sided inspection is required deep within concrete or brick. The purpose of this work was to explore the feasibility of using the backscattered radiation from a high-energy bremsstrahlung beam to detect the existence of a void in construction material. If the focal point of the detector collimator is centered on the void, the backscattered signal should be slightly different than from adjacent regions. By using the MCNP (Monte Carlo Neutron Photon) code to simulate the inspection, we can identify fundamental limitations of the technique as well as estimate design parameters of a practical system. This will reduce the time, effort, and expense for any subsequent experimental program to develop the technique. Our basic approach to the simulation was to keep the geometry as simple as possible but still realistic. The radiation source was a simulated 6-MeV bremsstrahling spectrum from a commercially available linac that is relatively small, portable, and can produce an output of 300 rad/min at 1 m. All shielding is assumed to be tungsten. The object being inspected is assumed to be a semi-infinite slab of homogenized concrete. Our "concrete" has the correct proportions of elements and the correct density, but none of the inhomogeneities caused by sand and aggregate in real concrete. The errors caused by this assumption will be discussed later. The nominal void we are trying to detect is air-filled sphere, 2.54 cm in diameter. We also assumed that the maximum depth of the void would be 45.72 cm. 2 refs.

19322 (LAL-RT–90-06) **Front-end electronics for H.E.P.** Hrisoho, A. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jul 1990. 34p. (CONF-9007244–: 3. ICFA

School on Instrumentation in Elementary Particle Physics, Rio de Janeiro (Brazil), 16-28 Jul 1990). Order Number DE92517870. Source: OSTI; NTIS (US Sales Only); INIS.

A simplified description of the front-end electronics used for High Energy Physics Detectors is given. A brief analysis of the speed limitation due to the time necessary for the detector charge transfer is given, which depends as well of the detector behaviour as of the preamplifier configuration. A description of the sample electronic circuits like differentiation, integration, pole zero circuit and preamplifier are given. Noise analysis is carried out to derive the relations for the equivalent noise signal for the measuring device with some description of practical noise measuring. The shaping of the signals to obtain an optimization for the noise is considered and some hints for shaping amplifier design, with a description of the noise weightling function for normal and time variant shaping are given.

19323 (LA-UR–92-764) **A new radiometer for earth radiation budget studies.** Weber, P.G. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205136–1: 1992 international geoscience and remote sensing symposium, Houston, TX (United States), 26-29 May 1992). Order Number DE92011267. Source: OSTI; NTIS; GPO Dep.

A critical need for the US Global Change Research Program is to provide continuous, well-calibrated radiometric data for radiation balance studies. This paper describes a new, compact, relatively light-weight, adaptable radiometer which will provide both spectrally integrated measurements and data in selected spectral bands. The radiometer design is suitable for use on (small) satellites, aircraft, or Unmanned Aerospace Vehicles (UAVs). Some considerations for the implementation of this radiometer on a small satellite are given. 17 refs.

19324 (LA-UR–92-936) **The Solenoidal Detector Collaboration silicon detector system.** Ziock, H.J.; Gamble, M.T.; Miller, W.O.; Palounek, A.P.T.; Thompson, T.C. Solenoidal Detector Collaboration. Los Alamos National Lab., NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920331–3: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE92011237. Source: OSTI; NTIS; INIS; GPO Dep.

Silicon tracking systems will be fundamental components of the tracking systems for both planned major SSC experiments. Despite its seemingly small size, it occupies a volume of more than 5 meters in length and 1 meter in diameter and is an order of magnitude larger than any silicon detector system previously built. This report discusses its design and operation.

19325 (LBL–31596) **Properties of CMOS devices and circuits fabricated on high-resistivity, detector-grade silicon.** Holland, S. Lawrence Berkeley Lab., CA (United States). Nov 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-911106–93: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92011727. Source: OSTI; NTIS; INIS; GPO Dep.

A CMOS process that is compatible with silicon p-i-n radiation detectors has been developed and characterized. A total of twelve mask layers are used in the process. The NMOS device is formed in a retrograde well while the PMOS device is fabricated directly in the high-resistivity silicon. Isolation characteristics are similar to a standard foundary CMOS process. Circuit performance using 3 μm design rules has been evaluated. The measured propagation delay and power-delay product for a 51-stage ring oscillator was 1.5 ns and 43 fJ, respectively. Measurements on a simple cascode amplifier results in a gain-bandwidth product of 200 MHz at a bias current of 15 μA. The input-referred noise of the cascode amplifier is 20 nV/$\sqrt{}$Hz at 1 MHz.

19326 (MPI-PhE–91-06) **Measurement of the position resolution of two-side readable silicon strip detectors with VLSI electronics.** Bauer, C. Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut; Technische Univ. Muenchen, Garching (Germany). Fakultaet fuer Physik. Nov 1991. 86p. (In German). Order Number DE92516647. Source: OSTI; NTIS (US Sales Only); INIS.

The two-side readable silicon strip detectors of the MPI-TU-MBB design were tested in connection with the VLSI electronics developed for this in a particle beam. By means of the data taken in an electron beam (50 GeV) and subsequently prepared by an especially developed procedure following studies were performed: the distribution of the energy loss of minimally ionizing particles in silicon was determined. The correlation between the signal-pulse heights of the two detector sides was measured. The signal-to-noise ratio was determined from the distribution of the energy loss. As essential factor for the reachable position resolution the shape of the signal charge distribution was studied. As consequence of the capacitative charge distribution charge losses between the strips occur. The influence of δ electrons on the width of the charge distribution and the reachable position resolution was detected. The dependence of the mean energy loss and the width of the charge distribution on the incident angle of the particle was determined. As essential result of this test the position resolution of both sides of these detectors was determined. The values, measured for this amount to 11.6 μm on the ϕ side and 15.7 μm on the z side. The angular dependence of the position resolution of the ϕ side was studied. The test in the particle beam yielded also some results, which make future studies necessary: The measurement have yielded differences in the position resolution of the two sides, which can only be partly explained by the geometry of the two detector sides. The position resolution is at-the-whole bader than expected. On both sides losses in signal charge occur. The signal-pulse heights of the ϕ side are lower than the corresponding signal-pulse heights of the z side. (orig./HSI).

19327 (OUP–92-02) **CHICSI - a proposal for a multidetector ΔE-E particle telescope.** Guttormsen, M. (ed.). Oslo Univ. (Norway). Fysisk Inst. Jan 1992. 21p. Order Number DE92628293. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of the CHICSI project is to build a silicon ΔE-E telescope system for the measurement of charged ejectiles produced in violent heavy ion collisions. Of particular interest is the detection of intermediate mass fragments in order to investigate the behavior of nuclear matter under extreme conditions. The report is a first attempt to determine the design parameters of the multidetector system CHICSI. The detector is intended to be used for experiments at the CELSIUS storage ring. Thus, the operation in a storage ring environment requires special attention to the ultra high vacuum condition and target arrangements. The multidetector system will be operated in conjunction with other detector systems as the slow heavy ion recoil detector. 11 refs., 9 figs., 3 tabs.

19328 (PCCF-RI–91-04) **A dilepton spectrometer project for SIS.** Meritet, L. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1991. 10p. (CONF-910396–: 1. European biennial workshop on nuclear physics, Megeve (France), 25-29 Mar 1991). Order Number DE92517869. Source: OSTI; NTIS (US Sales Only); INIS.

We present an experimental project to study e^+e^- pairs production in nucleus-nucleus collisions at GSI. Dileptons appear to be a clean probe to investigate in medium properties of nuclear form factors, baryon excitations (Δ) and mesons (π-dispersion relation; ρ-form factor) at high nuclear matter densities. The design of the detector system will be based on the experience obtained with the DLS-spectrometer at LBL and other dilepton detector systems in operation at high energy facilities. The project includes a fast electron trigger provided by a ring imaging Cherenkov detector with a segmented photomultiplier array.

19329 (PCCF-RI–91-07) **Field assisted photoemission by silicon photocathodes.** Aboubacar, A. (Clermont-Ferrand-2 Univ., 63 - Aubiere (FR). Lab. de Physique Corpusculaire); Dupont, M.; El Manouni, A.; Querrou, M.; Says, L.P.; Fabre, N.; Rossel, F. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1991. 13p. Order Number DE92517868. Source: OSTI; NTIS (US Sales Only); INIS.

Silicon photocathodes with arrays of tips have been prepared using microlithographic techniques. Current emission due to field effect has been measured in the case of heavy and weakly doped boron Silicon. An Argon continuous laser has been used to produce photocurrent. An instantaneous current (600 μA) with a moderate laser power (83 mW), has been produced on weakly doped photocathodes. This current corresponds to an average quantum yield (purely photoelectric) of about 1.7%, and a local current density in the range of a few 10^6 A m^{-2}.

19330 (PEL–306) **Characterization of the Schlumberger borehole gammametric system.** Prozesky, V.M.; Franklin, C.B. Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Feb 1991. 19p. Order Number DE92626985. Source: OSTI; NTIS (US Sales Only); INIS.

The expertise and equipment for γ-ray spectroscopy at the Nuclear Beam Technology group at Pelindaba was used to characterise a Schlumberger NaI-γ-ray detector. The detector is fitted in a drilling housing; and can be lowered down boreholes to trace radioactive or activated elements. This detector is specifically used for prospecting purposes, studying the γ-rays that accompany the presence of mining minerals. The problem of inconsistent results at high count rates was characterised, and the shift in amplifier gain was determined as a function of total count rate. The performance of the software to strip the elements of the spectrum was also checked and found to fail at count rates of 20 kHz and higher. The stabilisation circuit was found to become less effective already at moderate count rates ($\simeq$ 5kHz). The experiment was performed by comparing the count rate in five energy windows between the Schlumberger γ-ray detector and a Ge(Li) solid state γ-ray detector, where the lower efficiency and detection characteristics of this detector provided a reliable reference. The problem was largely solved by introducing lead shielding to allow the unit to stabilise itself more effectively at high count rates. With the addition of 3 mm lead shielding, the acceptable count rate was improved by a factor 2. 8 figs., 1 tab., 4 refs.

19331 (PHE–91-015) **The construction and performance of a large cylindrical wire chamber with cathode readout.** Deiters, K.; Donat, A.; Friebel, W.; Heller, R.; Kirsch, S.; Krankenhagen, R.; Lange, W.; Leiste, R.; Lohmann, W.; Lustermann, W.; Peng, Y.; Roeser, U.; Tonisch, F.; Trowitzsch, G.; Vogt, H.; Wilhelmi, M. Institut fuer Hochenergiephysik, Zeuthen (Germany). Dec 1991. 20p. Order Number DE92517038. Source: OSTI; NTIS (US Sales Only); INIS.

The construction and performance of two large coaxial cylindrical multiwire proportional chambers with cathode readout, denoted as Z-Detector, forming the outer part of the L3 central tracking detector, are described. Three self supporting cylinders of about 1 m length and 1 m diameter, constructed as a sandwich of Kapton foil and foam, form the mechanical frame. It represents 2% of a radiation length. In each chamber one cathode layer is subdivided in helical strips and the other one in rings. The readout of the charges induced on the cathode strips and the other one in rings. The readout of the charges induced on the cathode strips provides the avalanche position along the beam (z-) direction. The detector has been running in the L3 experiment at LEP for nearly two years. The resolution of the z-measurement is 320 μm, the double track resolution is about 10 mm. The efficiency of each chamber is 96%. (orig.).

19332 (PNL-SA–19981) **Use of tissue equivalent proportional counters to characterize radiation quality on the space shuttle.** Braby, L.A.; Conroy, T.J.; Elegy, D.C.; Brackenbush, L.W. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 7p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920431–24: Meeting on new horizons in radiation protection and shielding, Pasco, WA (United States), 26 Apr - 1 may 1992). Order Number DE92012347. Source: OSTI; NTIS; INIS; GPO Dep.

Tissue equivalent proportional counters (TEPC) are essentially cavity ionization chambers operating at low pressure and with gas gain. A small, battery powered, TEPC spectrometer, which records lineal energy spectra at one minute intervals, has been used on several space shuttle missions. The data it has collected clearly show the South Atlantic anomaly and indicate a mean quality factor somewhat higher than expected. An improved type of instrument has been developed with sufficient memory to record spectra at 10 second intervals, and with increased resolution for low LET events. This type of instrument will be used on most future space shuttle flights and in some international experiments.

19333 (SLAC-PUB–5745) **Studies of helium based drift chamber gases for high-luminosity low energy machines.** Boyarski, A. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Briggs, D.; Burchat, P.R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Feb 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ;AM03-76SF00010. (CONF-920219–1: 6. international wire chamber conference: wire chambers - recent trends and alternative techniques, Vienna (Austria), 17-21 Feb 1992). Order Number DE92012415. Source: OSTI; NTIS; INIS; GPO Dep.

Future high luminosity low energy machines will need low mass tracking chambers to order to minimize multiple scattering of the relatively low momentum tracks produced at these facilities. A drift chamber using a helium based gas rather than a conventional argon based gas would greatly reduce the amount of multiple scattering. This paper summarizes measurements of the drift velocity and position resolution for gas mixtures of helium with CO_2 and isobutane and helium with DME. Good spatial resolutions are obtained. A design of a drift chamber with only 0.12% of a radiation length (gas plus wire) over a 60 cm tracking distance is presented.

19334 (SLAC-PUB–5793) **Wire chamber gases.** Va'vra, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920219–2: 6. international wire chamber conference: wire chambers - recent trends and alternative techniques, Vienna (Austria), 17-21 Feb 1992). Order Number DE92012421. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we describe new developments in gas mixtures which have occurred during the last 3–4 years. In particular, we discuss new results on the measurement and modeling of electron drift parameters, the modeling of drift chamber resolution, measurements of primary ionization and the choice of gas for applications such as tracking, single electron detection, X-ray detection and visual imaging. In addition, new results are presented on photon feedback, breakdown and wire aging.

19335 (UCRL-JC–105226) **Quantitative radiography.** Logan, C.M.; Hernandez, J.M.; Devine, G.J. Lawrence Livermore National Lab., CA (United States). Feb 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910399–8: American Society for Nondestructive Testing spring conference, Oakland, CA (United States), 18-22 Mar 1991). Order Number DE92011523. Source: OSTI; NTIS; GPO Dep.

We have developed a system of quantitative radiography in order to produce quantitative images displaying homogeneity of parts. The materials that we characterize are synthetic composites and may contain important subtle density variations not discernable by examining a raw film x-radiograph. In order to quantitatively interpret film radiographs, it is necessary to digitize, interpret, and display the images. Our integrated system of quantitative radiography displays accurate, high-resolution pseudocolor images in units of density. We characterize approximately 10,000 parts per year in hundreds of different configurations and compositions with this system. Images are captured using DuPont NDT55 industrial x-ray film in Daypack™ packages. X-ray cabinets are of custom design, with helium flight path and a filter wheel for positioning filters if desired. The cabinets contain baffles to reduce scattered radiation and are equipped with drawer for rapid load/unload of parts. Separate units with tungsten-anode or copper-anode tubes are available. The usual operating voltage is 15 to 35 kVp. Fixturing provides for rough part positioning and precise alignment with respect to the x-ray source. Areal density standards are placed at several locations on each film. In interpreting the image, we use the standards nearest the image of the part being quantified. Because of this, small variations in x-ray flux uniformity (heel effects) are unimportant. The usual standard is a step wedge of aluminum containing 13 steps. Films are permanently labeled by imaging a perforated metal numbering strip. Data such as part number, step wedge identification, etc. are read from barcode labels and transferred to a data base for later retrieval and use in quantifying the image.

19336 (UCRL-JC-105234) **A method to track radiographic variables affecting image quality.** Weirup, D.L.; Devine, G.J.; Logan, C.M. Lawrence Livermore National Lab., CA (United States). Feb 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910399-5: American Society for Nondestructive Testing spring conference, Oakland, CA (United States), 18-22 Mar 1991). Order Number DE92011464. Source: OSTI; NTIS; GPO Dep.

Separating x-ray source fluctuations from film processing variations is a difficult task. We have established a system which monitors the performance of our film and film processing. In order to monitor consistency we have developed two devices, the "spotburner" and the "flasher." The spotburner allows us to expose uniform small spots using a Cd-109 source over representative areas of a film. For each production film batch to be processed we use two spotburner films, one leading and one trailing the production films. To identify these films we use the flasher to mark the films with time and data. Production film batch information as well as important processor parameters are recorded in a data base for analysis and to keep a historical record. Quantitative radiography is very sensitive to film and processor variations. These variations may be brought about by many causes. One cause could be variation in the emulsion across the surface of a film. When exposing a film for quantitative analysis a stepwise of a known material is exposed along with the part to be evaluated. Any emulsion changes from the area of the stepwedge to the area of the test piece can make significant errors in perceived x-ray attenuation. A second cause of variations are fluctuations in the output of the x-ray source or changes in the flight path. A third source of film variations are processor fluctuations. Changes in developer chemistry, developer and time water temperatures, and film movement rates through the processor can all causes a shift in apparent exposure from one side of a film to the other.

19337 (UCRL-JC-110134) **Condenser optics, partial coherence, and imaging for soft x-ray projection lithography.** Sommargren, G.E.; Seppala, L.G. Lawrence Livermore National Lab., CA (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9204120-1: Soft-x-ray projection lithography topical meeting, Monterey, CA (United States), 6-8 Apr 1992). Order Number DE92011762. Source: OSTI; NTIS; GPO Dep.

In this paper we have concentrated on the design and implications of condenser systems for an all reflective soft x-ray projection lithography system has five main components: the source, condenser (illumination system), mask, imaging system and wafer.

19338 (WSRC-MS-92-032) **Dry calorimetry at the Savannah River Site.** ReFalo, L.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011051. Source: OSTI; NTIS; GPO Dep.

Heat flow calorimeters are used at the Savannah River Site to assay radioactive sources by measuring the emitted thermal power. The radioactive source is placed in a constant temperature environment and its thermal output is measured by non-destructive assay techniques. The isotopic mass is computed from the measured power through known watts/gram constants for each of the isotopes. The Equipment Engineering Section of the Savannah River Laboratory has developed calorimetric techniques which provide major improvements over other calorimeters. Improvements are in the areas of greater precision, reduced maintenance, and thermal control without using water. The elimination of water reduces criticality concerns during assay of fissionable materials and reduces health concerns during assay of tritium. Equipment Engineering Section has developed two basic dry calorimeter designs. The designs are identical in concept; however, they differ to accommodate different power levels. Each design has been tested demonstrating proof of concept. The current designs are for low wattage samples, .1 to 10 watts, and high wattage samples, 40 to 140 watts.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 19265

19339 (SAND-92-0344C) **New insights into radiation-induced oxide-trap charge through thermally-stimulated-current (TSC) measurement and analysis.** Fleetwood, D.M.; Miller, S.L.; Reber, R.A. Jr.; McWhorter, P.J.; Winokur, P.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920716-4: Nuclear and space radiation effects conference, New Orleans, LA (United States), 13-17 Jul 1992). Order Number DE92009054. Source: OSTI; NTIS; GPO Dep.

In this summary, we re-evaluate estimates of trapped-hole energies inferred from TSC measurements and transistor annealing studies. Improved estimates of the trapped-hole "attempt-to-escape" frequency (υ_A) and a quantitative treatment of (Schottky) electric-field induced barrier lowering strongly suggest that previous estimates of trapped-hole energies in TSC and transistor annealing studies are too low. Moreover, we show that TSC measurements can be modeled analytically from first principles, and the resulting model can accurately predict TSC measurements under arbitrary heating conditions. Finally, we evaluate the dependence of electron trapping in irradiated SiO_2 on dose and on electric field during irradiation. 30 refs.

19340 (SAND-92-0357C) **Latent interface-trap buildup: issues for long-term device response.** Schwank, J.R.; Fleetwood, D.M.; Shaneyfelt, M.R.; Winokur, P.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920716-1: Nuclear and space radiation effects conference, New Orleans, LA (United States), 13-17 Jul 1992). Order Number DE92003148. Source: OSTI; NTIS; GPO Dep.

A large buildup in interface traps has been observed in commercial and radiation-hardened MOS transistors at very long times after irradiation (> 10^6 s). This latent buildup may have important implications for CMOS response in space. 13 refs.

19341 (SAND-92-0382C) **Qualifying commercial ICs for total-dose space environments.** Sexton, F.W. (Sandia National Labs., Albuquerque, NM (United States)); Fleetwood, D.M.; Pelletier, J.C.; Gaona, J.I. Jr.; Aldridge, C.C.; Garrett, G.; Fuller, E. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States); Defense Nuclear Agency, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920716-3: Nuclear and space radiation effects conference, New Orleans, LA (United States), 13-17 Jul 1992). Order Number DE92009069. Source: OSTI; NTIS; GPO Dep.

Total-dose failure levels are measured for commercial FPGAs using MIL-STD 883D method 1019.4 and a modified test protocol with a room-temperature biased anneal following irradiation. These are compared with device response to low dose-rate irradiations. 10 refs.

4405 Thermal Instrumentation

Refer also to citation(s) 19221

4406 Optical Instrumentation

Refer also to citation(s) 17815, 18989, 19009, 19360, 19363, 20375

19342 (BNL-47220) **Integrating figure and finish measurements with surface profiling instruments.** Takacs, P.Z. (Brookhaven National Lab., Upton, NY (United States)); Church, E.L. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9206142-1: 1. surface roughness and scattering, Tucson, AZ (United States), 1-3 Jun 1992). Order Number DE92011553. Source: OSTI; NTIS; GPO Dep.

Short communication. MIRRORS/surface properties; LENSES/surface properties; MEASURING INSTRUMENTS; OPTICS; MIRRORS; LENSES; OPTICAL PROPERTIES; OPTICAL SYSTEMS; SYNCHROTRON RADIATION SOURCES; ROUGHNESS; LIGHT SCATTERING

19343 (DOE/ER/61072–4) **Cosine response characteristics of radiometric and photometric sensors.** Michalsky, J.J.; Harrison, L.C.; Berkheiser, W.E. III. State Univ. of New York, Albany, NY (United States). Atmospheric Sciences Research Center. [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61072. (CONF-920678–2: National solar energy conference, Cocoa Beach, FL (United States), 13-18 Jun 1992). Order Number DE92011437. Source: OSTI; NTIS; GPO Dep.

Global and diffuse irradiance and illuminance are measured with instruments that are assumed to have true cosine responses. It is known, largely from reports with a limited distribution or by word of mouth, that no instrument is perfect in this regard. This paper reports on measurements of cosine responses for several instrument types and manufacture familiar to the solar radiation measurement community. The measurements were made with an automated cosine response test bench using the same protocol for each instrument. The cosine bench measures with variable angular resolution as fine as 0.25 degrees. The automated rotation is in one plane. A manual rotation allows measurements for other azimuths. 6 refs.

19344 (DOE/ER/61229–1) **[Center of excellence: Microlaser microscope]: Annual progress report.** Webb, R.H. Eye Research Inst. of Retina Foundation, Boston, MA (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61229. Order Number DE92013485. Source: OSTI; NTIS; GPO Dep.

This Center-of-Excellence grant has two components: development of an imaging system based on microlaser arrays forms a central project among a group of laser diagnostic and therapeutic efforts primarily funded outside the grant. In these first 8 months we have set up the Microlaser Microscope using small microlaser arrays. We have emphasized the basics of microlaser handling and electronic addressing and the optics of the microscope. Details of electronics and optics given here will be used in the larger arrays which should be available soon. After a description of the central Microlaser Microscope project, we touch briefly on the other projects of the Center, which have been outstandingly fruitful this year. Publications are necessarily concerned with the smaller projects, since the Microlaser Microscope is in its early stages.

19345 (ENEA-RT-NUCL–90-38) **Grating low-pass filters.** Tudisco, O. ENEA, Frascati (Italy). Area Nucleare. Apr 1991. 18p. (RT/NUCL–90-38). Order Number DE92506288. Source: OSTI; NTIS (US Sales Only); INIS.

Gratings are excellent low-pass filters, provided they have the appropriate mounting. The spectral reflectivity of filters composed of four gratings has been measured, from the 0.2 mm to 2 mm wavelength region. In order to contain the size of the gratings, they were placed near a lens focus, where the beam section is smaller. The effect of nonparallel light is to smooth the cut-off edge of the filters. The measurements are in good agreement with the diffraction theory of gratings.

19346 (SAND–91-2459) **Portable surveillance unit instruction manual.** Martinez, R.L. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011514. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Portable Surveillance Unit (PSU) is a small, self-contained unit that can easily be transported for quick setup in any surveillance application. The system is ideally suited for short-term, temporary, unattended video surveillance and recording applications, though it can operate continuously for three months, assuming a 5-minute interval to replace the video tape. Depending on the programmed interval, the PSU is capable of 24-hour internal battery operations, and longer periods when powered from ac main power. This document is a descriptive and instructional manual for the operation of the Portable Surveillance Unit.

19347 (SAND–91-2579) **Initial laboratory evaluation of color video cameras.** Terry, P.L. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92010399. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has considerable experience with monochrome video cameras used in alarm assessment video systems. Most of these systems, used for perimeter protection, were designed to classify rather than identify an intruder. Monochrome cameras are adequate for that application and were selected over color cameras because of their greater sensitivity and resolution. The increased emphasis placed on the identification objective of video security systems leads to the need to improve system designs and upgrade existing systems. Color information is useful for identification purposes, and color camera technology is rapidly changing. Thus, Sandia National Laboratories established an ongoing program to evaluate color solid-state cameras. This report describes test parameters and procedures and provides the results of an initial evaluation.

19348 (UCRL-CR–103698) **Dispersive-infrared gas sensor system design and operation manual.** Kulp, T.J.; McRae, T.G.; Kennedy, R.; Garvis, D. Lawrence Livermore National Lab., CA (United States). Oct 1991. 127p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011766. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to develop nondispersive infrared (IR) gas sensor capable of detecting and quantifying gaseous HCl emitted during the launch of rockets using solid propellants. To satisfy the practical requirements of this application, the sensor must be capable of unmanned field operation, remotely addressable, field calibratable, and able to measure low concentrations (1 ppm) of HCl at relatively rapid rates.

19349 (UCRL-JC–109219) **Resolution limits for ground based astronomical imaging using adaptive optics.** Olivier, S.S.; Max, C.E.; Gavel, D.T.; Brase, J.M. Lawrence Livermore National Lab., CA (United States). 10 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9203139–1: Laser guide star adaptive optics workshop, Albuquerque, NM (United States), 10-12 Mar 1992). Order Number DE92011949. Source: OSTI; NTIS; GPO Dep.

We study the residual jitter present in astronomical images after the effect of the earth's atmosphere has been compensated using a fast steering mirror. This residual jitter places a limit on the resolution that can be achieved for long exposure images even when more elaborate adaptive optics systems are used to correct the image. We assume that the fast guiding system uses a star as it reference source. Then, from the observed characteristics of Galactic stellar populations, we are able to predict the optimal performance of the fast guiding system as a function of the sky covering factor, that is the fraction of the sky for which the given level of performance can be achieved. The performance for a particular sky covering factor is optimized by choosing the appropriate closed-loop bandwidth and guide star magnitude. The performance also depends on a number of atmospheric and system parameters; however, we find that the optimal performance is relatively insensitive to all but two of these parameters, the telescope aperture size and the strength of the atmospheric turbulence. Therefore, we consider two specific examples: first, a ten meter telescope imaging an atmosphere with relatively weak turbulence (3/4 arcsecond seeing in V), and second, a one meter telescope imaging through an atmosphere with relatively strong turbulence (2 arcsecond seeing in V). For these cases we find, for example, that a residual jitter of less than 0.03 and 0.3 arcseconds respectively can be obtained over about half the sky for nominal choices of the other parameters. The required closed-loop bandwidths in these cases are about 5 and 20 Hz while the appropriate guide stars are approximately 18th and 14th magnitude in V. 6 refs.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 17980, 19406

4408 Miscellaneous Instrumentation

Refer also to citation(s) 17822, 18168, 18464, 18465, 18766, 18972, 19093, 19364, 19372, 19454, 19532, 19981, 20337

19350 (ANL/CP–75957) **On-line emissions monitoring of chlorobenzene incineration using Fourier transform infrared spectroscopy.** Mao, Zhuoxiong; McIntosh, M.J.; Demirgian, J.C. Argonne National Lab., IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920527–1: Incineration conference, Albuquerque, NM (United States), 11-14 May 1992). Order Number DE92013041. Source: OSTI; NTIS; GPO Dep.

Incineration of chlorobenzene in a small laboratory incinerator was monitored by using Fourier transform infrared spectroscopy (FTIR) coupled with a heated long-path cell (LPC) to analyze and quantify flue gas emissions in near real time. The effects of operating conditions under stable and decreasing incineration temperatures on the destruction of chlorobenzene were studied. The results from the decreasing temperature experiments were found to be consistent with those from experiments at stable temperatures. This finding demonstrates that the FTIR/LPC, as a continuous emissions monitor, can effectively detect dynamic changes in the incinerator emissions and can contribute significantly to the safety of incinerators.

19351 (ETDE-IT–92-27) **Telemetry in Italy (Abitare Domani marketing survey).** Mastrolilli, M.; Zullo, F. Agip-Petroli, Rome (Italy). 1991. 35p. (In Italian). (CONF-9111217–2: L'Europa dei teleservizi tecnici: le esperienze dei gestori e le prospettive di sviluppo, Rome (Italy), 21-22 Nov 1991). Order Number DE92506243. Source: OSTI; NTIS (US Sales Only).

A survey was conducted by an Italian organization called Abitare Domani (translation: living tomorrow) to determine the diffusion of the use of telemetric equipment in Italy. The Organization developed a questionnaire to monitor the use of telemetric equipment in a variety of industrial, commercial, residential and public service applications, e.g., industrial plant on-line control for plant operation, performance monitoring, maintenance and safety; telecommunications; building energy management; security; etc. This paper reports some of the first results.

19352 (ETDE-IT–92-28) **Tele-management communications systems marketing in France.** Le Gal, Yann. 1991. 12p. (In French). (CONF-9111217–3: L'Europa dei teleservizi tecnici: le esperienze dei gestori e le prospettive di sviluppo, Rome (Italy), 21-22 Nov 1991). Order Number DE92506244. Source: OSTI; NTIS (US Sales Only).

This paper surveys the types of telemetric equipment available on the market in France. Brief notes are provided on the performance capabilities of telemetric equipment used in a variety of industrial, commercial, residential and public service applications, e.g., industrial plant on-line control for plant operation, performance monitoring, maintenance and safety; telecommunications; building energy management; security; etc.

19353 (LA-UR–92-789) **Readily implemented enhanced sinusoid detection in noise.** Lindsay, K.V. Los Alamos National Lab., NM (United States). 5 Mar 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011359. Source: OSTI; NTIS; GPO Dep.

Significant efforts have been devoted, spanning many years, to the problem of sinusoid detection in noise. Many of these efforts have produced superb, yet complex, algorithms which may be difficult to use for a wide segment of the Digital Signal Processing (DSP) community. This paper presents a simple, easily implemented and high effective method which solves this problem. This method severely degrades non-sinusoidal noise while leaving the embedded sinusoid(s) relatively undisturbed. The algorithm, simply put, exploits the difference between the net effect of integration and differentiation of sinusoids versus the effect of these operations on random noise and other signal sequences. The cross-correlation of sine wave with its differentiated (and/or integrated) self is quite high. Conversely, the cross-reduction of a noise sequence with its differentiated (and/or integrated) self is much lower. Therefore, it is reasonable to assume that for sequences consisting of a sinusoid in noise, significant signal-to-noise-ratios (SNRs) in the correlation results are achievable using a combination of differentiation (and/or integration) and cross-correlation operations on such sequences. This technique has been applied to actual Doppler radar data, as well as to synthesized data, with excellent improvement in signal detection capability. 4 refs.

19354 (RFP–4529) **Improvements to the Rocky Flats Metrology Laboratories Velocity Meter Calibration System.** Abercrombie, K.R. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 12 Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. Order Number DE92013162. Source: OSTI; NTIS; GPO Dep.

The Rocky Flats Standards Laboratory has undertaken a project to improve calibration of air velocity meters by reducing the uncertainty of the Velocity Meter Calibration System. The project was accomplished by analyzing the governing equation in order to determine which areas within the system contributed most to the overall system uncertainty. Then, based upon this new analysis, new components were selected to replace the components identified in the analysis. Finally, the system was re-evaluated to determine the new systematic uncertainty for the system.

19355 (SAND–92-0410) **Primary Standards Laboratory Report: Second half 1991.** Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013290. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories operates the Primary Standards Laboratory (PSL) for the Department of Energy, Albuquerque Operations Office (DOE/AL). This report summarizes metrology activities that received emphasis in the second half of 1991 and provides information pertinent to the operation of the DOE/AL system-wide Standards and Calibration Program.

19356 (SAND–92-0518C) **Random vibrations measurements with isolated accelerometers.** Paez, T.L. (Sandia National Labs., Albuquerque, NM (United States)); Gibson, B.W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205127–2: Institute of Environmental Sciences symposium, Nashville, TN (United States), May 1992). Order Number DE92011186. Source: OSTI; NTIS; GPO Dep.

Isolated accelerometer measurement systems are used to measure environments composed of a wide spectrum of frequencies including the natural frequency of the isolated accelerometer. Because the isolated accelerometer measurement system is a nonlinear system, it is subject to the potential for chaotic vibrations. it is clear that this potential if realized, affects the response of the measurement system to vibration input and perhaps to shock input also. This paper explores the effects that the potential for chaotic vibrations and nonlinear response, in general, has on the random vibration response of the isolated accelerometer measurement system. Specifically, the system response to white noise is investigated and assessed in terms of response histogram and response spectral density. 6 refs.

19357 (UCRL-MA–107572) **User's guide supplement for NEC-GS.** Burke, G.J. Lawrence Livermore National Lab., CA (United States). May 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011445. Source: OSTI; NTIS; GPO Dep.

NEC-GS is a reduced version of NEC-3 optimized for modeling a vertical monopole on a uniform radial-wire ground screen. With NEC-GS, large radial wire ground screens can be modeled with the radial wires included in the moment-method solution and the effect of ground included through an accurate evaluation of the Sommerfeld integrals. NEC-GS can be used to model any wire structure with azimuthal symmetry, as long as the excitation also has azimuthal symmetry. The moment-method solution involves no basic approximations, such as assumed currents or field values, as are often used in modeling radial wire ground screens. There are, however, limitations in the solution method that can result in inaccurate results under some conditions. Accuracy questions are discussed to some extent in Section 3. NEC-GS should be used with caution until more validation has been done and the accuracy is better understood.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 19089, 19141, 19829

19358 (CONF-920458–6) **Cathodic protection activities in the inactive fleet.** Lloyd, D.B. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Corrosion '92 conference and exhibition; Nashville, TN (United States); 27 Apr - 1 may 1992. Order Number DE92011679. Source: OSTI; NTIS; GPO Dep.

Responsibility for US Navy ships that are designated "inactive" resides with the Inactive Fleet Division of the Naval Sea Systems Command. Many of the ships that are removed from active service are retained in case of future need. Inactivation and preservation procedures must be thorough and long lasting, for the inactive status period may be as much as 20 years or more. One of the principle techniques used is that of cathodic protection, in which electric potentials are used to retard corrosion. In 1987 the Oak Ridge National Laboratory (ORNL) was engaged by the US Navy Inactive Fleet to review the manner in which cathodic protection (CP), was being implemented at the various Naval Inactive Fleet Maintenance Facilities (NISMFs).

19359 (CONF-920747–1-Extd.Abst.) **Electrostatic ion thruster optics calculations.** Whealton, J.H (Oak Ridge National Lab., TN (United States)); Raridon, R.J.; Kirkman, D.A. Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC05-84OR21400. From 28. joint propulsion conference; Nashville, TN (United States); 6-8 Jul 1992. Order Number DE92006608. Source: OSTI; NTIS; INIS; GPO Dep.

Two- and three-dimensional ion thruster optical calculations including both source and exhaust plasmas are performed. These calculations include both a self-consistent ion source extraction plasma sheath and an explicit computation of the primary ion optics including sheath and electrode induced aberrations. A study determining the effects of beam space charge, accelerator geometry, and properties of the downstream plasma sheath on the position of the electrostatic potential saddle point near the extractor electrode is made. Results of the electron blocking potential barrier height as a function of electrode thickness and secondary plasma processes are described.

19360 (EGG-PHY–10134) **Imaging system (INEL): FY-91 Summary report.** Partin, J.K.; Lassahn, G.D.; Davidson, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012366. Source: OSTI; NTIS; GPO Dep.

This progress report gives a brief description of the general automatic target recognition system algorithms developed for this project, and also summarizes the progress in fiscal 1991. An appendix discusses the proposed computer hardware for this system.

19361 (LA-UR–92-104) **Artificial Intelligence for Explosive Ordnance Disposal System (AI-EOD).** Madrid, R.; Williams, B.; Holland, J. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920758–1: Innovative applications of artificial intelligence; International joint conference on neural networks, San Jose, CA (United States); Baltimore, MD (United States), 13-15 Jul 1992; 7-11 jun 1992; CONF-9206102–1). Order Number DE92007587. Source: OSTI; NTIS; GPO Dep.

Based on a dynamically configurable neural net that learns in a single pass of the training data, this paper describes a system used by the military in the identification of explosive ordnance. Allowing the technician to input incomplete, contradictory, and wrong information, this system combines expert systems and neural nets to provide a state-of-the-art search, retrieval, and image and text management system.

19362 (SAND–91-2343) **1991 rocket-triggered lightning test of the DOD Security Operations Test Site (SOTS) munitions storage bunker, Ft. McClellan, Alabama: Volume 1.** Schnetzer, G.H.; Fisher, R.J. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012449. Source: OSTI; NTIS; GPO Dep.

During June and July 1991, the Sandia Transportable Lightning Instrumentation Facility (SATTLIF) was fielded at the Department of Defense (DoD) Security Operations Test Site (SOTS) at Ft. McClellan, Alabama. Nine negative cloud-to-ground lightning flashes were artifically triggered to designated locations on Igloo 2, a weapons storage bunker specially prepared to allow instrumentation access to various of its structural and electrical system elements. Simultaneous measurements of the incident flash currents and responses at 24 test points within the igloo and its grounding counterpoise network were recorded under lightning attachments to the front and rear air terminals of the structure's lightning protection system. In Volume I the test is described in detail. The measured data are summarized and discussed. Appendix A contains the full set of recorded incident flash currents, while Appendix B presents the set of largest responses measured at each test point, for both front and rear attachments to the structure. As part of these tests, 0.050-in-thick stainless steel, 0.08-in copper, and 0.08-in titanium samples were exposed to triggered flash currents. In this way, damage spots created by direct-strike triggered lightning have been obtained, along with the measurement of the return-stroke and continuing currents that produced them. These data points, along with similar ones on aluminum and ferrous steel obtained during 1990 will be used as benchmarks against which to quantify the fidelity of burnthrough testing achievable Sandia's advanced laboratory lightning simulator.

19363 (SAND–91-2495-Vol.1) **NAASW modular radar research testbed study results: Volume 1.** Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 294p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011339. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Sandia National Laboratories has defined conceptual design approaches, development costs and development schedules for a synthetic-aperture radar testbed system for imaging of the ocean. The proposed system, referred to herein as the Modular Radar Research Testbed (MRRT), is capable of simultaneous operation at multiple frequencies. The design features a nearly autonomous radar operating at each frequency. The architecture minimizes the number of frequency-dependent modules in the system and supports a variety of real-time imaging modes, including side-looking strip map, squinted strip map, coherent spotlight, long-dwell squint (multiple images of the same scene from different squint angles), interferometry, and polarimetry. This volume: (1) Identifies salient system features and modules; describes system modes; provides systems specifications and block diagrams. (2) Presents requirements for the study. (3) Describes the various aspects of the system's architecture (generic data link, Digital Signal Processor, Image Processing Assembly, etc). (4) Provides descriptions of system modes of operation (strip map, squinted strip map, interferometry, etc.). and (5) Contains descriptions of analyses relating to interferometry and Displaced-Phase-Center Antenna.

19364 (SAND–91-2495-Vol.2) **NAASW modular radar research testbed study results: Volume 2.** Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 299p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011340. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Sandia National Laboratories has defined conceptual design approaches, development costs and development schedules for a synthetic-aperture radar testbed system for imaging of the ocean. The proposed system, referred to herein as the Modular Radar Research Testbed (MRRT), is capable of simultaneous operation at multiple frequencies. The design features a nearly autonomous radar operating at each frequency. The architecture minimizes the number of frequency-dependent modules in the system and supports a variety of real-time imaging modes, including side-looking strip map, squinted strip map, coherent spotlight, long-dwell squint (multiple images of the same scene from different squint angles), interferometry, and polarimetry. This volume (1) analyzes calibration requirements for the multi-channel SAR architecture; (2) presents studies of microwave portions of the system (intermodulation products, phase noise, etc.); (3) describes the high-accuracy navigation techniques and our method for applying motion compensation data; (4) reports results of various MRRT analyses (image-formation techniques, multi-look algorithms, squint mode, etc.); and (5) contains vugraphs from the SNL MRRT technical review held in February 1991.

19365 (SAND–91-2664) **B-52G/H nuclear certification tasks performed by the Aircraft Compatibility Division at Sandia National Laboratories.** Stevenson, L.E.; Wifall, J.R. Sandia National Labs., Albuquerque, NM (United States). Feb 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013681. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report documents aircraft compatibility evaluations performed on the current versions of the B-52G/H aircraft and how those efforts led to the recommendation that the aircraft be added to the Aircraft Compatibility Control Drawing (ACCD) of an associated bomb or warhead system. The B-52 Aircraft Compatibility personnel, Division 5147, shall initially assemble this document and then update it on a yearly basis as defined in Reference 1.

19366 (SAND–92-0024) **Quasistatic modeling and testing of exclusion region barrier mock-ups.** Wellman, G.W.; Salzbrenner, R. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92012686. Source: OSTI; NTIS; GPO Dep.

The first phase of a program to study the resistance of exclusion region barriers to ductile failure when subjected to accident-type, quasi-static extreme mechanical loads has been completed. This first phase consisted to qualification of the analytical tools used to study these types of structural deformations and the development of appropriate criteria to predict ductile failure. A series of tests were performed on hydroformed half-cylinder barrier mock-ups. The qualification activity was considered a success based upon the comparison of the deformations and loads measured during the testing to the response of these structures computed by the finite element modeling. This successful completion of the first phase allows the second phase program to proceed. 12 refs.

19367 (SAND–92-0404C) **Three-dimensional shock wave physics simulations on massively parallel supercomputers.** Gardner, D.R.; Fang, H.E. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920771–1: 1992 summer computer simulation conference, Reno, NV (United States), 27-30 Jul 1992). Order Number DE92008679. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Three applications of massively parallel computing to weapons development at Sandia National Laboratories are briefly described, including armor/antiarmor simulations. The numerical modeling of penetrator-armor interactions requires detailed, three-dimensional simulation of complex interactions of exotic materials at high speeds. Massively parallel version of CTH and MESA, Eulerian hydrocodes developed in part for armor/antiarmor simulations, are being developed for popular architectures. The codes include models for elastic-plastic material deformation, fracture, and high explosives. Typical armor/antiarmor penetration simulations conducted on massively parallel computers with these codes are presented. The associated speedups as the simulation size is increased indicate that high parallel efficiencies can be achieved for realistic problems. These simulations demonstrate that massively parallel hydrocodes can provide highly-detailed, three-dimensional simulations of armor/antiarmor systems.

19368 (UCRL-JC–107399) **Quartz finger mixers.** Jacoby, B.A.; Burginyon, G.A. Lawrence Livermore National Lab., CA (United States). Nov 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920367–7: Department of Defense (DOD) fiber optics conference, McLean, VA (United States), 25 Mar 1992). Order Number DE92011947. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. QUARTZ/reflectivity; OPTICAL FIBERS; QUARTZ; REFLECTIVITY; GAIN; X-RAY DETECTION; STREAK CAMERAS; FLUORESCENCE

19369 (UCRL-JC–109718) **Assessing the impact of reduced airspeed on tiltrotor support to ground combat.** Warshawsky, A.S.; Olness, D.U.; Uzelac, M.J. Lawrence Livermore National Lab., CA (United States). 14 Feb 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9206153–1: 48. annual forum and technology display of the American Helicopter Society (AHS), Washington, DC (United States), 3-5 Jun 1992). Order Number DE92011329. Source: OSTI; NTIS; GPO Dep.

This paper reports the sensitivity of assessments of tiltrotor effectiveness for supporting ground combat to reductions in airspeed of V-22s carrying external sling loads. Attrition to ground-based air defenses realized in the simulations is presented. Finally, results of the supported ground combat are presented. 2 refs.

19370 (UCRL-JC–109817) **Automated operations planning: Modeling MLRS operations.** Cunningham, C.T. Lawrence Livermore National Lab., CA (United States). 5 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920771–3: 1992 summer computer simulation conference, Reno, NV (United States), 27-30 Jul 1992). Order Number DE92011917. Source: OSTI; NTIS; GPO Dep.

The multiples launch rocket system (MLRS) is a highly survivable and automated complement to conventional cannon artillery. For best survivability against counter-battery fire, MLRS operations rely on rapid "shoot-and-scoot" tactics by widely dispersed launchers. Such tactics may be difficult to include in a battlefield simulation without requiring players for the individual MLRS items: launchers and resupply vehicles. To reduce this demand on player resources, a computer model has been developed to automate the behavior of the items, consistent with the published operations doctrine. A player is required to determine the area of operation and certain key locations for an MLRS firing platoon. Analysis of trafficability in the operations area and direction the movement of the items, as the perform fire missions, resupply, and replenishment of platoon stocks, is completely automated. A finite state machine representation of the items is used. The model is currently implemented on a VAX 6310. It will be integrated with the Janus battlefield trainer.

19371 (UCRL-JC–109840) **Polygon framing in UCCATS.** Grum, H.G.; Samuelson, N.H. Lawrence Livermore National Lab., CA (United States). 24 Feb 1992. 5p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920771–2: 1992 summer computer simulation conference, Reno, NV (United States), 27-30 Jul 1992). Order Number DE92011971. Source: OSTI; NTIS (US Sales Only); GPO Dep.

UCCATS is a high resolution urban combat simulation designed to support analysis, training and operational planning applications for the armed forces. Urban modeling requires higher resolution terrain than models such as Janus. Polygons of arbitrary size provide the necessary detail. The number of polygons easily becomes large enough to violate run-time speed requirements. Polygon framing provides an effective filter to eliminate polygons from expensive movement and line of sight calculations.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 19443, 19936

19372 (SAND–90-1326) **The collection, handling, transportation, and thermal desorption of explosive vapor using quartz collection tubes.** Rodacy, P.J.; Ingersoll, D. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States); Department of the Treasury, Washington, DC (United States); Department of Justice, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011441. Source: OSTI; NTIS; GPO Dep.

This work describes the collection, handling, transportation, thermal desorption, and analysis of explosive vapors using quartz collection tubes. A description of the sampling system is presented, along with the collection efficiency of the quartz tubes and some of the precautions necessary to maintain the sample integrity. The design and performance characteristics of the thermal desorption system are also discussed. Collection of explosive vapor using empty, 0.25 inch O.D. by 5.25 inch long quartz tubes at a flow rate of 200 mL min-1 is quite different. Thermal desorption of the explosive vapor molecules using a furnace that allows control of the gas phase chemistry in the IMS has been shown to provide a reliable, reproducible means of analysis. Empty quartz tubes provide a sharper desorption profile than packed collection tubes, resulting in a better signal-to-noise ratio, and perhaps, a lower detection limit than packed quartz tubes. Both the ion drift time of the explosive and its desorption characteristics can provide a means of identification. Sample handling, packaging, and transportation methods which minimize sample loss and contamination have been developed and evaluated.

19373 (UCRL-CR-110256) **Computed tomography experiments of Pantex high explosives.** Perkins, D.E. (Lawrence Livermore National Lab., CA (United States)); Martz, H.E.; Hester, L.O.; Sobczak, G.; Pratt, C.L. Lawrence Livermore National Lab., CA (United States); Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (United States). Apr 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013517. Source: OSTI; NTIS; GPO Dep.

X-ray computed tomography is an advanced imaging technique which provide three-dimensional nondestructive characterization of materials, components and assemblies. The CT Project group at Lawrence Livermore National Laboratory (LLNL) and the Pantex Plant are cooperating to examine the use of CT technology to inspect and characterize high-explosives pressings (e.g. PBX-9502, LX-10-2). High-explosives pressings manufactured by Pantex must be characterized prior to assembling into weapons systems; a nondestructive examination of all assembly parts would be preferable to the current sampling and destructive testing. The earlier in the processing cycle this can be done the more cost effective it will be. We have performed experiments that show that this characterization can be performed at the pressed billet stage using CT. We have detected 2-mm inclusions in a 15-cm diameter billet and 3.5-mm voids in a 20-cm diameter billet. Based on these results we show calculations that can be used to design production CT systems for characterization of high-explosives. 11 refs.

19374 (UCRL-JC-108985) **Turbulent dusty boundary layer in an ANFO surface-burst explosion.** Kuhl, A.L.; Ferguson, R.E.; Chien, K.Y.; Collins, J.P. Lawrence Livermore National Lab., CA (United States). Jan 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707-28: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92012101. Source: OSTI; NTIS; GPO Dep.

This paper describes the results of numerical simulations of the dusty, turbulent boundary layer created by a surface burst explosion. The blast wave was generated by the detonation of a 600-T hemisphere of ANFO, similar to those used in large-scale field tests. The surface was assumed to be ideally noncratering but contained in initial loose layer of dust. The dust-air mixture in this fluidized bed was modeled as a dense gas (i.e., an equilibrium model, valid for very small-diameter dust particles). The evolution of the flow was calculated by a high-order Godunov code that solves the nonsteady conservation laws. Shock interactions with dense layer generated vorticity near the wall – similar to viscous, no-slip effects found in clean flows. The resulting will shear layer was unstable, and rolled up into large-scale rotational structures. These structures entrained dense material from the wall layer and created a chaotically striated flow. The boundary layer grew due to merging of the large-scale structures and due to local entrainment of the dense material from the fluidized bed. The chaotic flow was averaged along similarity lines (i.e., lines of constant values of $x = r/Rs$ and $y = z/Rs$ where $R_s = ct^{\alpha}$) to establish the mean-flow profiles and the r.m.s. fluctuating-flow profiles of the boundary layer.

19375 (UCRL-JC-108986) **Evolution of reactants fluid volume in turbulent jets.** Kuhl, A.L. (Lawrence Livermore National Lab., CA (United States)); Bell, J.; Ferguson, R.E.; Chien, K.Y.; Collins, J.P. Lawrence Livermore National Lab., CA (United States). Jan 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920707-27: 24. international symposium on combustion, Sydney (Australia), 5-10 Jul 1992). Order Number DE92011298. Source: OSTI; NTIS; GPO Dep.

Numerical simulations of the evolution of an axisymmetric gaseous fuel jet penetration into a liquid oxidizer were performed with a multifluid version of a high-order Godunov code. The fuel jet was unstable and rapidly broke up into mixing structures with a variety of length scales. The complexity of the mixing increased with increased grid resolution. However, grid refinement studies demonstrated that the reactants volume (i.e., the fuel volume within specified concentration limits) rapidly converged to a solution that was insensitive to the mesh size.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 18131, 18810, 19875

19376 (DOE/NV-296-Rev.1) **A perspective on atmospheric nuclear tests in Nevada fact book: Revision 1.** Friesen, H.N. Raytheon Services Nevada, Las Vegas, NV (United States). Apr 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-91NV10833. Order Number DE92012298. Source: OSTI; NTIS; INIS; GPO Dep.

This Fact Book provides historical background and perspective on the nuclear testing program at the Nevada Test Site (NTS). Nuclear tests contributing to the off-site deposition of radioactive fallout are identified, and the concept of cumulative estimated exposure is explained. The difficulty of associating health effects with radiation is presented also. The status of litigation against the government and legislation (as of December 1991) are summarized.

19377 (MLM-3731) **Testing the B-90 cap release using strobe photography.** Cornwell, D.P.; Robbins, V.E.; McCoy, G.W. Mound, Miamisburg, OH (United States). 9 Apr 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-88DP43495. Order Number DE92012413. Source: OSTI; NTIS; GPO Dep.

This report presents the data collected during the testing of different cap designs for the XMC4231 cap release. The testing was performed to document the feasibility of the proposed WR (War Reserve) test method in the event that this program is revived in the future. Before the program's cancellation, several cap designs were constructed and subjected to simulated hail in the laboratory to determine hail impact resistance. The hail-tested units, identical control units, and practice units were tested in a method similar to that proposed as the WR production acceptance test for the cap release function. This report discusses problems encountered and ideas developed during the tests and presents a short discussion of the cap designs.

19378 (SAND-91-2329) **Development report for Group II SA3642 Surge Protector Assembly.** Grieco, S.E. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013456. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The SA3642 is the Surge Protector Assembly portion of the MC4078 Lightning Arrestor Connector Surge Protector used in the W89 missile-warhead interface. The SA3642 is a connector assembly that holds filters for attenuation of high-frequency noise and diodes for transient suppression on each contact. The development plan for the MC4078 calls for three development groups of material to be fabricated and evaluated prior to Process Prove-In and Pilot Production. This report documents the device performance measured, experience gained, and the plans generated by the second development group.

19379 (UCRL-CR-109639) **Fickian filtering of cavity gases rising through a fractured permeable overburden.** Nilson, R.H. (S-Cubed, La Jolla, CA (United States)); Lie, K.; Peterson, E.W. Lawrence Livermore National Lab., CA (United States); S-Cubed, La Jolla, CA (United States). [1987]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (SSS-R-88-8687;CONF-870961-12: 4. symposium on containment of underground nuclear explosions, Colorado Springs, CO (United States), 21-24 Sep 1987). Order Number DE92010439. Source: OSTI; NTIS; INIS; GPO Dep.

In naturally or explosively fractured geologic media most of the responsibility is associated with the fracture network, whereas most of the porosity resides within the matrix blocks. Thus, both levels of porosity, fracture and matrix, are important in controlling the transient migration of radioactive gases from an underground nuclear cavity to the earth's surface. A numerical model of a double-porosity medium is used to investigate the upward transport of contaminant resulting from a moderate post-collapse overpressure in the chimney and/or critical pumping due to atmospheric pressure variations. It is found that the threat of rapid arrival through fractures is greatly mitigated by the process of Fickian diffusion which "filters" the contaminated gases as they rise through the fractures. Because of differences in concentration, contaminant species are drawn out of the rising gases into the surrounding porous matrix which contains relatively fresh air. The effectiveness of this Fickian filtering process depends on the aperture and spacings of fractures. Thus, consideration is given to the question of estimating these parameters of a double-porosity medium using field measurements such as barometric pressure data.

19380 (UCRL-JC-105269) **Godunov methods on a staggered mesh: An improved artificial viscosity.** Christensen, R.B. Lawrence Livermore National Lab., CA (United States). 2 Nov 1990. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9011149-20: 1990 nuclear explosives code developers' conference, Monterey, CA (United States), 6-9 Nov 1990). Order Number DE92011973. Source: OSTI; NTIS (US Sales Only); GPO Dep.

We present a method for obtaining a High-Order, Non-Oscillatory hydro scheme for staggered mesh, internal energy-based codes using a simple modification of the standard von-Neumann artificial viscosity method. This modification is derived by applying the Godunov technique directly to a staggered mesh and replacing the full Riemann solution by a particular approximate Riemann solver. It will be shown to deliver results much better than the standard scheme and comparable to other modern hydro methods.

4504 Nuclear and Radiological Warfare

19381 (LA-12293-MS) **Errata to crisis stability indices for adaptive two-layer defenses.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92012400. Source: OSTI; NTIS; GPO Dep.

An earlier treatment overestimated the survivability of an attacker's non-alert aircraft and hence their contribution to his first strike. This report corrects the error and discusses its impact, which is primarily important for ground-based defenses. It reduces the attacker's aircraft survival rates to about those of the defender's, improving the stability properties of space-based defenses.

4505 Strategic Defense Initiative

Refer also to citation(s) 18727

19382 (LA-12197-MS) **Burros: Simple, affordable, effective space transportation.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92013553. Source: OSTI; NTIS; GPO Dep.

This note argues that space is the best place to put not only the sensors, but also the SBIs Spare Based Interceptors and DEWs Directed-Energy Weapons needed to address long-range, intra- and inter-theater missiles efficiently. There are real threats; they are likely to worsen. Ground-based defenses cannot handle them all affordably. Mixes are generally appropriate. There is a role for SBIs, but it doesn't appear to require all of the capabilities built into the current SBIs at the outset. The SBIs that are needed now could be no more than cheap burros that were amenable to joint development and robust command for the protection of all. Their deployment for (GPALs) Global Protection Against Limited Strikes should not adversely impact the arms control or crisis stability of the strategic balance with the Soviet Union in any rational, concrete calculus, including that used by the Soviet Union. Deployment at low latitudes should give them adequate capability against theater launches but none against Soviet (ICMBs) International Ballist Missiles and only marginal, residual impact on (SLBMs) Submarine-Launched Ballistics Missiles. They should not either leave hot production capability of anything threatening or provoke untoward responses. We have a hot production line on Chevrolets that would pose more of a threat to the Soviet Union. Their inability to overcome even crude Soviet countermeasures would be an asset in this light. A companion effort could develop the brilliant eyes needed to guide them. A similar logic is possible with DEWs, but they are less developed and hence less at issue. 57 refs.

19383 (LA-12294-MS) **Stability of large offensive force reductions.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92013554. Source: OSTI; NTIS; GPO Dep.

The effect of decreasing offensive forces with fixed defenses is much like that of increasing defenses with fixed offenses as studied in "Crisis Stability." Both increase stability. Even moderate boost-phase defenses strongly attrit first-strike missiles. Preferential attrition by downstream interceptors reduces missile strikes on value is larger with defenses than without, because of the increased survivability of non-alert aircraft. Without defenses the fraction of the defender's Inter-Continental Ballistic Missiles (ICBMs) that survive the first strike is essentially zero. With defenses the number that survive and penetrate boost-phase defenses is significant, but the number that penetrate the preferential defenses downstream rapidly falls to zero. Without defenses the second-strike aircraft are limited to alert aircraft. With defenses the number is essentially the full number of aircraft, which is much larger. Without defenses the total restrike is the sum of missiles and alert aircraft; with defenses it is all of the aircraft. The cost for striking first without defenses differs, but other strike costs are clustered. With defenses the stability index rapidly goes to unity; without them the stability index remains lower throughout. With defenses, the expected number of missile weapons on value drops rapidly to zero; without defenses it remains high to low levels of offensive forces. This pattern holds for various combinations of defenses and attacks. Without defenses, offensive reductions could lead to large reductions in stability; with defenses, large reductions would increase stability. 3 refs.

19384 (LA-12298-MS) **Phase-space estimate of satellite coverage time.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92013555. Source: OSTI; NTIS; GPO Dep.

This note derives a phase-space estimate of the overlap in satellite coverage and evaluates its impact on the time for a constellation to cover some specified area. The satellites' motion is treated as random in the calculation of the overlaps. Enough passes are prescribed to assure that an adequate probability of observing each area is accumulated. For 0.9–0.99 probabilities of coverage, overlaps increase the time for coverage by factors of 2–4 over no-overlap estimates. This model also gives the probability of different vintages of data. If a given constellation covers the whole Earth in the no-overlap time T_0, the average vintage of the data over the earth will then be the average $\langle T \rangle$, which is essentially the same as T_0. Overlap over the poles might be wasteful, but overlap in areas of interest by inclined orbits just causes measurements to be more current in areas of interest.

19385 (LA-12299-MS) **Technical issues in theater missile defense.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92014176. Source: OSTI; NTIS; GPO Dep.

This note discusses technical issues in theater missile defenses in the terminal, midcourse, and boost phases. The first two are familiar and developed, but face fundamental countermeasures. Boost phase intercepts engage missiles when they are most vulnerable, but have been studied less for theater defense because the engagement times are short. Overall, theater missile defenses resemble strategic defenses, complicated by the tenfold shorter boost phase. 12 refs.

19386 (SAND–91-2155C) **A coilgun design primer.** Marder, B. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204102–3: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92011149. Source: OSTI; NTIS; GPO Dep.

This paper explains how an induction coilgun works and presents the factors which go into its design. Our purpose is to obtain algebraic expressions which, although crude, provide useful predictors of behavior, illustrate the dependence on various parameters, and suggest ways to optimize the design. Detailed prediction of the gun's behavior can be obtained from simulation codes, such as SLINGSHOT.

19387 (SAND–92-0460C) **Space applications for contactless coilguns.** Lipinski, R.J.; Beard, S.; Boyes, J.; Cnare, E.C.; Cowan, M.; Duggin, B.W.; Kaye, R.J.; Morgan, R.M.; Outka, D.; Potter, D.; Widner, M.M.; Wong, C. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204102–4: 6. symposium on electromagnetic launch technology, Austin, TX (United States), 28-30 Apr 1992). Order Number DE92011156. Source: OSTI; NTIS; GPO Dep.

Two space applications are considered for (electrically) contactless coilguns: launch of small satellites into low-earth orbit, and launch of lunar liquid oxygen (LLOX) from the moon to the stationary Lagrangian point L2. For the earth-to-orbit (ETO) application, the baseline conceptual design consists of a 960-m long gun sited in a tunnel at 25° inclination. The gun launches an 1820-kg package that includes a 100-kg satellite and a 650-kg boost rocket for orbital insertion. For the lunar application, the launcher is 200 m long. A 100-kg load of LLOX is packaged in a 10-kg fiber-wrapped tank, accelerated at 2 kgees in an aluminum bucket (armature), and launched at 2.33 km/s at 30-minute intervals. The canisters arrive at L2 2.97 days later and are captured by robotic tugs that deliver them to a fuel depot. The total mass of LLOX derived per year is 867 Mg (metric tons).

19388 (UCRL-CR–110115) **Notes for a tutorial on DEW signal generation, propagation, and detection.** Casey, K.F. (JAYCOR, Del Mar, CA (United States)). Lawrence Livermore National Lab., CA (United States); JAYCOR, Del Mar, CA (United States). Oct 1987. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011847. Source: OSTI; NTIS; GPO Dep.

These notes were prepared to support a two-day tutorial lecture series which was presented at Headquarters, Air Force Foreign Technology Division in October 1987. The intent of the lectures was to provide an introduction to, and overview of, three subject areas relevant to the electromagnetic aspects of the Directed Energy Intelligence (DEWINT) problem. These areas are (1) signal generation by charged-particle beams (CPB) and high-power microwaves (HPM), (2) propagation of electromagnetic signals through the ionosphere, and (3) performance of correlation receivers for signal detection. The level of the material was intended to be suitable for an audience whose technical background was at the BS or MS level in electrical engineering or physics.

54 ENVIRONMENTAL SCIENCES

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 17770, 17778, 17780, 17781, 17782, 17783, 17785, 17788, 17789, 17790, 17791, 17792, 17793, 17794, 17795, 17796, 17797, 17798, 17799, 17800, 17802, 17818, 17820, 17912, 18014, 18017, 18098, 18113, 18156, 18169, 18171, 18172, 18182, 18200, 18201, 18204, 18206, 18207, 18224, 18225, 18270, 18281, 18385, 18628, 18671, 18731, 18743, 18748, 18779, 18785, 18786, 19020, 19037, 19042, 19121, 19354, 19453, 19484, 19513, 19516, 19556, 19565, 19871, 19921, 19922, 19923, 20441

19389 (ANL/ESD/TM–23) **Removal and recovery of carbon disulfide emitted by the viscose process: Final report.** McIntosh, M.J. Argonne National Lab., IL (United States). Energy Systems Div. Feb 1992. 186p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States); Illinois State Government, Springfield, IL (United States). DOE Contract W-31109-ENG-38. Order Number DE92012160. Source: OSTI; NTIS; GPO Dep.

Teepak, Inc., which manufactures cellulose food casings by means of the viscose process, has a plant in Danville, Illinois, that emits approximately 400,000 cubic feet per minute (cfm) of water-saturated air containing approximately 100 parts per million (ppm) of carbon disulfide (CS_2). Both Teepak and the state of Illinois desire to reduce these emissions as soon as possible; however, the large air flow and very small CS_2 concentration result in a difficult and costly separations problem without an obvious economically viable solution. One possibility is to incinerate the CS_2, but a more environmentally and economically acceptable alternative is to recover the CS_2 for recycle to the process. The recovered CS_2 would be worth about $700,000 annually to Teepak. Teepak has sponsored, with the Hazardous Waste Research and Information Center (HWRIC) of the Illinois Department of Natural Resources, a research project at Argonne National Laboratory (ANL) to evaluate current gas- purification and recovery technology and to suggest a route of development that will lead to a CS_2 recovery process. The Illinois Department of Commerce and Community Affairs later provided on Illinois Challenge Grant to allow laboratory studies to supplement this effort. This report is a result of all those studies.

19390 (CONF-9103215–, pp. 163-169) **In-home performance of residential cordwood stoves.** Houck, J.E. (OMNI Environmental Services, Inc., Beaverton, OR (United States)); Barnett, S.G.; Roholt, R.B. USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

The air quality impacts of residential cordwood stoves have been of concern to regulators, energy planners, and members of the woodstove industry. In addition, the reliability of laboratory certification emission values in predicting 'real world' emissions has been questioned. In response to these concerns, particulate emissions from residential cordwood stoves under actual in-home use have been measured for 5 heating seasons as part of 12 separate studies in Oregon, New York, Vermont, and the Yukon Territory. Monitoring was conducted using an automated emission sampler (AES) system. The system has been deployed in nearly 100 individual homes. Typically, emissions from several 1-week-long integrated sampling periods over the course of the heating season were measured with the AES system at each home. Particulate emission rates in grams of particles per hour of stove operation, grams of particles per kilogram of dry wood burned, and grams of particles per million Joules were calculated. Ancillary data provided by the studies included wood burn rates, homeowner wood loading patterns, wood moisture content and species, hours of operation of auxiliary heating appliances in the study homes, room ambient, flue gas, catalyst, and pre-catalyst temperatures, and hours of catalyst operation. Conventional stoves, high-technology non-catalytic stoves, catalytic stoves, and stoves equipped with retrofit catalytic devices have been studied. In addition to the 12 cordwood stove studies, the AES system has been used in 2 pellet stove studies and 1 fireplace study.

19391 (CONF-9105202–, pp. 11, Paper 6) **Modeling molecular processes in the environment.** Dunning, T.H. Jr (Pacific Northwest Lab., Richland, WA (United States)); Xantheas, S.S.; Hess, A.C.; Feller, D.F.; Kendall, R.A.; Ornstein, R.L. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC06-76RL01830. From 1.

energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

The US Department of Energy is committed to a 30-year pan for environmental restoration at all of its sites. To meet these commitments DOE has organized an ambitious Research, Development, Demonstration, Testing and Evaluation program. The technical problems identified in the RDDT and E plan are extremely complex and require thorough, permanent and cost-effective solutions. Basic research lays the foundation for each step in the RDDT and E program, providing new knowledge and techniques for site characterization, needs assessment, innovative remediation technology, and post-remediation evaluation and monitoring. Theoretical and computational molecular science will play a critical role in developing molecular-level descriptions of the complex system found in the environment. Theory provides the conceptual framework for the analysis and interpretation of experimental data. Modeling and simulation provides quantitative information which may be expensive, difficult or impossible to obtain in the laboratory. Further, theory, modeling and simulation provides insights into the fundamental factors governing molecular structure and dynamics which cannot be obtained from experiment alone.

19392 (CONF-9105202–, pp. 12, Paper 8) **Cloud radiative forcing: A modeling perspective.** Potter, G.L. (Lawrence Livermore National Lab., Livermore, CA (United States)); Slingo, J.M.; Morcrette, J.J. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract W-7405-ENG-48. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

In order to produce a projection of future climate, models used for climate research must produce realistic cloud amount, cloud structure and cloud radiative properties. To this end, a series of simulations were performed at the Program for Climate Model Diagnosis and Intercomparison (PCMDI) at LLNL using the supercomputer resources at NERSC to help determine why different climate models produce different cloud feedbacks. The simulations were designed to first facilitate model validation with a high resolution model and second, to evaluate methods for model intercomparison.

19393 (CONF-9110375–, pp. 213-216) **Studies on environmental risk assessment on mercury contained in flue gas from incineration plants.** Terashima, Y. (Kyoto Univ., Kyoto (Japan). Faculty of Engineering); Sogabe, H.; Shimizu, Y. Japan Society of Waste Management Experts, Tokyo (Japan). 28 Oct 1991. 488p. (In Japanese). From 2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991. In *Proceedings of the 2nd annual conference of the Japan society of waste management experts.* Order Number DE92514163. Source: OSTI; NTIS (US Sales Only).

This paper prsents the framework for a risk assessment on toxic substances generated from waste disposition. The framework was applied to mercury discharged into atmosphere from incineration plants to evaluate its effects through lung respiration and oral intake of drinking water. The highest surface landing concentration was 12.1 ng/m^3 at a point with distance of 8.5 km from the discharging source, located leeward of the source, the most frequent wind direction. This value is thought to have a small effect on the environment when compared to the guideline value of 15μg/m^3 recommended by WHO and the ordinary mercury concentration in general atmosphere. A value of mercury concentration in soil at the point of the highest surface landing concentration from the precipitated flux was calculated at 0.114 mg/kg. This value is slightly larger than the background concentration of 0.1 mg/kg in non-polluted soil, which causes a concern about its effect on the environment as a result of discharge and accumulation over a long period of time. 5 refs., 3 figs., 2 tabs.

19394 (CONF-9203118–1) **Parallel algorithms for the spectral transform and semi-lagrangian transport methods.** Drake, J.B. (Oak Ridge National Lab., TN (United States)); Williamson, D.L.; Foster, I. Oak Ridge National Lab., TN (United States). 17 Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Computer hardward advanced mathematics and model physics (CHAMMP) science meeting; Las Vegas, NV (United States); 17 Mar 1992. Order Number DE92011902. Source: OSTI; NTIS; GPO Dep.

Short communication. CLIMATE MODELS/iterative methods; ITERATIVE METHODS/parallel processing; ALGORITHMS; ARRAY PROCESSORS

19395 (CONF-920444–26) **Searching for perchloric acid salts in laboratory hoods at Oak Ridge National Laboratory.** Phillips, C.C.; Bader, M.; Haskew, M.W.; Mueller, T.R.; Stewart, J.H. Jr.; Vick, D.O.; Watkins, R.M. Oak Ridge National Lab., TN (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92011788. Source: OSTI; NTIS; GPO Dep.

In the 50 years that Oak Ridge National Laboratory (ORNL) has been conducting energy research, many operations have involved the use of hot perchloric acid in laboratory hoods. The salts resulting from such operations, if accumulated in these systems, can possible lead to flammable and explosive conditions, placing users and maintenance personnel at risk. In 1991, ORNL initiated a study to determine whether these hoods and exhaust systems were contaminated with perchlorate salts. A perchloric acid committee was established at ORNL consisting of industrial hygienists, chemists, engineers, and health physicists, as well as personnel from industrial safety, fire protection, and environmental compliance. The committee was tasked to identify systems where perchloric acid had been used, determine associated risks, and make recommendations for abatement procedures. The study was divided into a five-phase approach: (1) identification of hoods and systems currently and historically used for hot perchloric acid procedures (questionnaire survey); (2) development of evaluation procedures (testing and analytical); (3) actual testing/sampling of suspect/confirmed hoods; (4) analysis of results of samples (determination of risks and acceptable contamination level); and (5) development of decontamination procedures (purpose to decontaminate, repair, and remove if necessary).

19396 (CONF-920527–2) **Laboratory measurements of metal adsorption from simulated incinerator flue gases: Sorbent selection for cesium capture.** Crosley, S.M.; Kedl, R.J. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Incineration conference; Albuquerque, NM (United States); 11-14 May 1992. Order Number DE92013287. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Protection Agency (EPA) has proposed that the emission of acid gases, particulates, and ten specific metals in the flue gas of incineration be regulated. In addition, the Department of Energy is interested in minimizing the emission of radioactive metals in such flue gas. Dry scrubbing is an attractive alternative to wet scrubbing for the removal of these materials. Laboratory-scale experiments were conducted to measure the adsorption of cesium by silica at 1000–1300°F. Silica was found to be an effective sorbent for cesium. A methodology was developed for pre-selecting suitable sorbents for specific metals for future testing.

19397 (DOE/EA–0542) **Environmental assessment for the Cheap Access to Orbit (CATO) (formerly Super High Altitude Research Project-SHARP) at the Lawrence Livermore National Laboratory.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Jan 1992. 22p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012183. Source: OSTI; NTIS; GPO Dep.

Advanced Applications, a Division of Laser Programs at LLNL, is proposing to conduct Cheap Access to Orbit (CATO) experimental tests at Site 300 High Explosives Test Facility. CATO will utilize a two-stage light gas gun to propel projectiles (consisting of non-explosive light metals and polymers) of up to 10 kg (26 lb) at velocities up to 7 km/s (4 mi/s) with methane and hydrogen serving as propellants. The purpose of CATO is to test the cost-effectiveness and particality of using a two-stage light gas gun to place metric-ton payloads into earth orbits. There is a need to reduce the cost for constructing and maintaining orbital systems for national defense interests, space exploration, and development of worldwide communications and information systems. Potential environmental, safety, and health effects are associated with CATO. Noise and ground motion associated with gun firings, air emissions resulting from combustion of a methane-air mixture and hydrogen, energy consumption, and hazardous waste generation from post-firing, gun-tube wipedown are direct results from operation of the CATO gun. Noise and shock will be mitigated by special construction features (e.g., construction of a berm and gun design features) at the gun location. Air emissions are 84% nitrogen and water and 14% carbon dioxide and do not present a significant environmental concern. A thorough review by LLNL's health and safety professionals assures operational safety (LLNL, 1990). The test experiment will comply with applicable environmental, health, and safety regulations and will employ good engineering and construction practices. Potential off-site impacts will be mitigated by a thorough engineering and safety peer review that will continue through the modifications to the experimental design during scaleup of the experiment during the first year.

19398 (DOE/EA-0546) **Building 12-42F modification, Pantex Plant, Amarillo, Texas: Final Environmental Assessment.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Feb 1991. 15p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012266. Source: OSTI; NTIS; INIS; GPO Dep.

The Environment Assessment (EA) has been prepared pursuant to the implementing regulations to the National Environmental Policy Act (NEPA), which require federal agencies to assess the environmental impacts of a proposed action to determine whether that action requires the preparation of an Environmental Impact Statement (EIS) or if a Finding of No Significant Impact (FONSI) can be issued. NEPA requires that an EA provide an interdisciplinary review of the proposed action in order to identify possible preferable alternatives and to identify mitigative measures that will prevent environmental impacts. If it is determined that the proposed action will have unavoidable significant environmental impact, then as EIS shall be prepared. The proposed project is to modify Building 12-42F and entry into the Sandia Pantex Weapons Evaluation Test Laboratory. The modification's primary function is to provide additional space for testing and monitoring equipment to support the activities in the existing Building 12-42F. The modification will also facilitate the reconfiguration of the personnel offices, break room and conference area. The proposed Building 12-42F modification relates to the interiors of Buildings 12-42F and 12-42A. These buildings contain a centrifuge and associated testing and monitoring equipment. The proposed addition will encompass the existing entry into Building 12-42A. Building 12-42A will be accessed through the proposed Building 12-42F modification.

19399 (DOE/ER-0541T) **Computer Hardware, Advanced Mathematics and Model Physics pilot project final report.** USDOE Office of Energy Research, Washington, DC (United States). Office of Health and Environmental Research. May 1992. 126p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013750. Source: OSTI; NTIS; INIS; GPO Dep.

The Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) Program was launched in January, 1990. A principal objective of the program has been to utilize the emerging capabilities of massively parallel scientific computers in the challenge of regional scale predictions of decade-to-century climate change. CHAMMP has already demonstrated the feasibility of achieving a 10,000 fold increase in computational throughput for climate modeling in this decade. What we have also recognized, however, is the need for new algorithms and computer software to capitalize on the radically new computing architectures. This report describes the pilot CHAMMP projects at the DOE National Laboratories and the National Center for Atmospheric Research (NCAR). The pilot projects were selected to identify the principal challenges to CHAMMP and to entrain new scientific computing expertise. The success of some of these projects has aided in the definition of the CHAMMP scientific plan. Many of the papers in this report have been or will be submitted for publication in the open literature. Readers are urged to consult with the authors directly for questions or comments about their papers.

19400 (DOE/ER/60314-10) **Analysis of general circulation model results and comparison with regional climatic data, Task 3: [Progress report].** Cess, R.D.; Hameed, S. State Univ. of New York, Stony Brook, NY (United States). Inst. for Atmospheric Sciences. [1989]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60314. Order Number DE92011602. Source: OSTI; NTIS; GPO Dep.

On time scales of greater than one year the variability of weather and climate on a large path of the Earth is dominated by the Southern Oscillation. While current theories of this phenomenon have clarified the role of the interaction between the ocean and the atmosphere in maintaining this oscillation it has so far been unclear whether the Southern Oscillation originates in the ocean, in the atmosphere or during the interaction between the ocean and the atmosphere. In this study we compared simulations of climate in two global circulation models: the coupled OSU GCM in which the atmosphere and ocean interact dynamically and the slab OSU GCM in which the ocean is represented by a static layer.

19401 (DOE/ER/60314-T3) **Comparisons of model simulations of climate variability with data, Task 2: [Progress report].** State Univ. of New York, Stony Brook, NY (United States). [1990]. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60314. Order Number DE92011601. Source: OSTI; NTIS; GPO Dep.

Significant progress has been made in our investigations aimed at diagnosing low frequency variations of climate in General Circulation Models. We have analyzed three versions of the Oregon State University General Circulation Model (OSU GCM). These are: (1) the Slab Model in which the ocean is treated as a static heat reservoir of fixed depth, (2) the coupled upper ocean-atmosphere model in which the ocean dynamics are calculated in two layers of variable depths representing the mixed layers and the thermocline; this model is referred to OSU2 in the following discussion, and (3) the coupled full ocean-atmosphere model in which the ocean is represented by six layers of variable depth; this model is referred to as OSU6 GCM in the discussion.

19402 (DOE/ER/61072-2) **Development of rotating shadowband spectral radiometers and GCM radiation code test data sets in support of ARM: Technical progress report.** Michalsky, J.; Harrison, L. State Univ. of New York, Albany, NY (United States). Atmospheric Sciences Research Center. 17 Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61072. Order Number DE92011438. Source: OSTI; NTIS; GPO Dep.

Two tasks are included in the second year of this project. One task continues the collection of high quality data sets for the testing of radiation codes within climate models. The other task involves the development of accurate spectral instruments for the measurement of shortwave radiation. A third task was completed in the second half of the first year of the project and will be briefly summarized.

19403 (DOE/ER/61219-1) **Exploitation of parallelism in climate models: [Annual] report, 1 September 1991-29 February 1992.** Baer, F.; Tribbia, J.J.; Williamson, D.L. Maryland Univ., College Park, MD (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER61219. Order Number DE92012595. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) through its CHAMMP initiative, hopes to develop the capability to make meaningful regional climate forecasts on time scales exceeding a decade, such capability to be based on numerical prediction type models. We propose research to contribute to each of the specific items enumerated in the CHAMMP announcement (Notice 9103); i.e., to consider theoretical limits to prediction of climate and climate change on appropriate time scales, to develop new mathematical techniques to utilize massively parallel processors (MPP), to actually utilize MPP's as a research tool, and to develop improved representations of some processes essential to climate prediction. To explore these initiatives, we will exploit all available computing technology, and in particular MPP machines. We anticipate that significant improvements in modeling of climate on the decadal and longer time scales for regional space scales will result from our efforts. This report summarizes the activities of our group during a part of the first year's effort to meet the objectives stated in our proposal. We will comment on three research foci, time compression studies, subgrid scale model studies, and distributed climate ensemble studies and additional significant technical matters.

19404 (DOE/ER/61220–1) **Development of an advanced representation of cumulus convection: Progress report.** Emanuel, K.A. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61220. Order Number DE92011031. Source: OSTI; NTIS; GPO Dep.

Development of the new representation of cumulus convection, emphasizing the role of microphysical parameters, was completed. The newly developed cumulus scheme was coupled with a detailed representation of radiative transfer, in the context of a one-dimensional radiative-convective equilibrium model that includes the ocean as part of the calculations. The adjustable parameters of the scheme are microphysical in nature. They include the parcel precipitation efficiencies, ϵ_i, which are defined as the fraction of condensed water converted to precipitation in samples of air lifted reversibly from the subcloud layer; σ_d, the areal fraction covered by unsaturated downdraft; and σ_s, the fraction of precipitation assumed to fall outside of cloud.

19405 (EUR–12503(v.4)) **Development of modelling and forecasting in geology (Volume 4): Actual climates representative of past climates: Basis of bio-climate model.** Courbouleix, S. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Colleau, A.; Defaut, B.; Fourniguet, J.; Peaudecerf, P. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 55p. (In French). Contract FI1W/0048-F. Source: OSTI; NTIS (US Sales Only).

To access the long-term safety of radioactive waste disposal systems, validation of predictive models is essential and large efforts should be given to barriers, particularly geologic barriers. This work appears in the form of four volumes, the subject of the fourth part is described below. The purpose of this study is to find actual climates which can represent past climates in Europe, during Plio-Quaternary Palynology technics is the most adapted to restore ancient climates. A climatic index, Q_n is defined as a function of yearly rainfalls, monthly extreme temperatures and aridity. A climatic diagram is built with climatic index Q_n along X axis and a function of the yearly mean temperature along Y axis. This original method can ensure vegetation determination from climate and vice versa. Erosion and Weathering values may be determined after model calibration. 23 figs., 21 refs.

19406 (GKSS–90/E/13) **Remote sensing of tropospheric water vapor and carbon dioxide height profiles by use of a Raman lidar.** Riebesell, M. (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany). Inst. fuer Physik). GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany); Hamburg Univ. (Germany). Fachbereich 12 - Physik. 1990. 127p. (In German). Order Number DE92516553. Source: OSTI; NTIS (US Sales Only).

This dissertation describes a lidar system for the height-resolved determination of tropospheric water vapor and carbon dioxide mixing ratios. The measurement is based on the detection of the backscattered Raman radiation following the transmission of a laser pulse. The apparatus was built and its properties were investigated. Profiles of both H_2O and CO_2 could be obtained, but the required precision of ±1 ppm CO_2 can not yet be achieved because of a fluorescence background which is hard to quantify with the present measurements system. Height profiles of water vapor can be measured to about 8 km. Radiosonde comparison measurements show excellent agreement. With the atmospheric extinction coefficient determined from the oxygen Raman signal, the different atmospheric attenuation of backscattered light of the signal and reference wavelengths can be corrected for. (orig.) With 63 figs., 17 tabs.

19407 (GSF-HY–1/91, pp. 125-134) **Study into the isotope stratigraphy of a 16 m deep firn core from the Russian station Druzhnaya-1, Filchner shelf ice, (Antarctica).** Graf, W.; Moser, H.; Reinwarth, O.; Rauert, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The tritium accumulation was measured in annual samples derived after a first stratigraphic evaluation of the 0-18 and deuterium profiles. This method is sufficient for the purpose of isotopic dating, as the high tritium accumulations of the years 1965 and 1966 are clearly detectable as time marks. The calculated accumulation rates of the years 1952 through 1985 show a relatively strong variation. From the empirical δ 0-18 temperature relationship, an averaged warming of ground air by 0.057 K/year can be derived for the Druzhnaya-1 site for the period 1952 through 1980. (DG).

19408 (GSF-HY–1/91, pp. 156-157) **Krypton-85 concentrations in the atmosphere.** Schuhbeck, S.; Rauert, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The 1990 annual average of atmospheric Kr-85 is reported from the measuring stations Neuherberg (1.11 Bg/m^3) and Mappenberg (1.16 Bg/m^3). These values show an increase by 1.2% or 0.7%, respectively, as compared to the previous year. (DG).

19409 (IFE/KR/E–92/002) **Worldwide status of long range atmospheric transportation models for use in emergency situations.** Tveten, U. Institutt for Energiteknikk, Kjeller (Norway). Feb 1992. 17p. Order Number DE92627916. Source: OSTI; NTIS (US Sales Only); INIS.

This report contains the results of the work of a working group put together in order to summarize the status of long range atmospheric transportation models for use in an emergency situation in real-time mode. The most important characteristics of the various models are summarized. The models in use in the Nordic countries as well as a couple of non-Nordic models are presented in more detail. A discussion of the desired characteristics of real-time models (also referred to as Emergency Response Assisting Systems) is included.

19410 (INIS-GB–435) **Sixth annual report of RADMIL 1990/91.** Radioactivity Monitoring in Lancashire (RADMIL), Lancaster (United Kingdom). 1991 123p. Order Number DE92628023. Source: OSTI; NTIS (US Sales Only); INIS.

This sixth annual report of RADMIL draws together all parts of the programme of monitoring of radiation and radioactivity in Lancashire from April 1990 to March 1991, including work on radon and intertidal areas, which in previous years has been published separately, and measurements relating to internal exposure from airborne particulates and foodstuffs, i.e. milk, meat, aquatic foods, vegetables etc. (UK).

19411 (INIS-mf–13183, pp. 39) **South African study on radon in dwellings.** Leuschner, A.H. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); De Beer, G.P.; Steyn, A.; Strydom, R.; Bain, C.A.R. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. HOUSES/indoor air pollution; RADON/radioecological concentration; CHARCOAL; GAS TRACK DETECTORS; HOUSES; RADIOACTIVITY; RADON; SEASONAL VARIATIONS; SOUTH AFRICAN ORGANIZATIONS; URANIUM

19412 (INIS-mf–13183, pp. 39) **The quantification of radon potential of soils.** Bain, C.A.R. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Hancke, J.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In

SAAPMB summer school and congress. Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADON/soils; BUILDINGS; ECONOMIC DEVELOPMENT; GOLD; GOVERNMENT POLICIES; LAWS; MINING; RADIATION MONITORING; RADIATION PROTECTION; RADIOACTIVITY; RADIUM; RADON; SOILS; RESIDUES; SOUTH AFRICAN ORGANIZATIONS; URANIUM; WITWATERSRAND

19413 (INIS-mf--13183, pp. 40) **Radon exhalation measurements with activated charcoal.** Van Staden, M.L. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Strydom, R.; Steyn, A.; Leuschner, A.H. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132--: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADON/activated carbon; ADSORPTION; EXHALATION; MINES; PUBLIC HEALTH; RADIOACTIVITY; RADON

19414 (INIS-mf--13183, pp. 40) **The radon calibration facility at the AEC.** Steyn, A. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Jooste, S.C. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132--: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADON/calibration; AEROSOL MONITORING; AIR QUALITY; DAUGHTER PRODUCTS; EMANOMETERS; RADON; CALIBRATION; SOUTH AFRICAN ORGANIZATIONS

19415 (INIS-mf--13183, pp. 40) **A concept for removal of radon gas and its daughters from mine air.** Strydom, R. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Leuschner, A.H. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132--: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. MINES/radon; AIR; BUILDUP; DAUGHTER PRODUCTS; FILTRATION; HEALTH HAZARDS; INHALATION; MINES; RADON; MITIGATION; SCRUBBING; VENTILATION; WORKING CONDITIONS

19416 (INIS-SU--313, pp. 13-18) **Radionuclides in the environment and some geophysical problems.** Styro, B.I. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Two types of radionuclides contained in the atmosphere are studied including inert radioactive gas ^{85}Kr possessing no chemical bonds at normal temperatures and dissolved in water, and radioactive iodine isotopes possessing multiple chemical bonds under the same conditions and wide possibilities of penetration to the earth hydrosphere. It is shown that with regard to expected nuclear power progress and respective increase of ^{85}Kr concentration in the surface atmosphere layer the ion production near the Earth can achieve the value of 5.0 ion/(cm^{3}xs), this, in its turn, changes notably the electric conductivity in the lower troposphere and leads to the reduction of the total negative charge of the planet and decrease of sedimentation in equatorial and pre-equatorial regions of the Earth where sediments are linked with storm formation. Investigation into radioactive iodine isotopes, and especially ^{129}I, has shown that these isotopes are the products of the nuclear fuel cycle plant releases. They actively penetrate to the atmosphere and remain in all geospheres of the Earth and participate in all processes occuring in them due to multiple chemical bonds. A conclusion is made about the necessity in the nature dosimetry and its protection against pollution. 5 refs.; 3 figs.

19417 (INIS-SU--313, pp. 66-69) **Hot particles at the territory of the Lithuanian SSR.** Luyanas, V.; Shpirkauskajte, N.K.; Yasyulenis, R.Yu.; Adlis, G.I. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

To investigate a possibility of hot alpha- and beta-particle presence in the air after the Chernobyl accident, exposure of filters containing atmospheric aerosols in contact with nuclear A-2 type emulsion is conducted. It is shown that the maximum hot beta-particle concentration in the air of Vilnius was observed 28-29.04.86. Study of few alpha-particle traces allows one to assume that ^{239}Pu, ^{233}U, ^{23}'4U, ^{235}U, ^{242}Cm, ^{214}Po are present in them. In some particles only ruthenium radioisotopes are observed. 3 refs.; 2 tabs.

19418 (INIS-SU--313, pp. 82-89) **Measuring technique for aerosol and gas components of iodine isotopes in the air.** Nedvetskajte, T.N.; Filistovich, V.I. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

The AGI sampler for aerosol and gas iodine isotope components is developed, tested and introduced at the Physical Institute of the Lithuanian Academy of Sciences to determine the radioactive iodine isotope concentration in the atmospheric air with regard to differen forms of their aggregate state. After the Chernobyl accident the quantity of radioactive iodine isotopes in the air medium is determined using the AGI. Substantial quantities of I^{131}I and'1^{32}I and ^{133}I traces in aerosol and gas forms are detected. 5 refs.; 5 figs.; 1 tab.

19419 (JSR--91-330A) **Small satellites and RPAS in global-change research: Summary and conclusions.** Banks, P.; Cornwall, J.M.; Dyson, F.; Fortson, N.; Koonin, S.; Max, C.; MacDonald, G.; Ride, S.; Ruderman, M.; Treiman, S.; Vesecky, J.; Westervelt, R.; Zachariasen, F. Mitre Corp., McLean, VA (United States). Jason Program Office. Jan 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90ER30174. Order Number DE92013602. Source: OSTI; NTIS; INIS; GPO Dep.

JASON has now conducted two studies on the use of small satellites and remotely-piloted aircraft (RPAs) in global change research, with special reference to the DOE Atmospheric Radiation Measurement (ARM) program and to DARPA's Small Satellite program. The studies centered around meetings, one in January and the other in June 1991, to which we invited representatives of all areas of the global change program and of the DOD satellite science and technology community. We have already issued a report on the January study. Here we summarize the main themes and results of our Summer Study; the full report will be issued shortly.

19420 (Juel--2512) **Contributions to the environmental specimen bank. Pt. 7. Development and application of an automatic hydride method for arsine enrichment for the determination of arsenic compounds in algae, mussels and sea water with the HPLC. Investigation of different arsenic compounds in marine organisms of the German North Sea coast and Baltic Sea coast; comparison with specimens from Antofagasta, Chile.** Arenas C, V.J. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemie 4 - Angewandte Physikalische

Chemie; Bonn Univ. (Germany). Aug 1991. 186p. (In German). Order Number DE92511438. Source: OSTI; NTIS (US Sales Only).

In environmental analysis, total arsenic analysis is not sufficient since the toxicity of the arsenic depends on the compound form. For the determination of the respective compound form, a sensitive hydride AAS method for arsenic concentrations was developed in the ng and pg range together with an extraction technique for different arsenic compounds from marine organisms. The HPLC was selected and optimized as separation method; the different arsenic compounds which remain in the extract according to the extraction of the biological specimens were separated and analyzed. The total technique was used for the investigation of algae, mussels and water specimens of the North Sea and Baltic Sea and the Pacific (coast of Chile). The results were compared and discussed. (BBR).

19421 (KIYal–90-46) **The problem of creation of radiation monitoring system.** Pilipchak, S.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 14p. (In Russian). Order Number DE92626188. Source: OSTI; NTIS (US Sales Only); INIS.

The review of problem of radiation monitoring system (RMS) in the territory of the country is presented. Unsolved problems are discussed which are divided into three groups: the organization of structures in RMS; implementation of automated RMS; the solution of scientific problems of global monitoring of radiation situation. 12 refs.; 1 tab.

19422 (LA–12271-MS) **Environmental surveillance at Los Alamos during 1990.** Los Alamos National Lab., NM (United States). Mar 1992. 336p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011705. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program conducted by Los Alamos National Laboratory during 1990. Routine monitoring for radiation and radioactive or chemical materials is conducted on the Laboratory site as well as in the surrounding region. Monitoring results are used to determine compliance with appropriate standards and to permit early identification of potentially undesirable trends. Results and interpretation of data for 1990 cover external penetrating radiation; quantities of airborne emissions and effluents; concentrations of chemicals and radionuclides in ambient air, surface waters and groundwaters, municipal water supply, soils and sediments, and foodstuffs; and environmental compliance. Comparisons with appropriate standards, regulations, and background levels provide the basis for concluding that environmental effects from Laboratory operations are small and do not pose a threat to the public, Laboratory employees, or the environment.

19423 (LA-UR–92-949) **Small satellite radiation budget instrumentation.** Weber, P.G. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9204112–1: 2. small satellite technology and applications, Orlando, FL (United States), 20-24 Apr 1992). Order Number DE92011134. Source: OSTI; NTIS; GPO Dep.

A major diagnostic in understanding the response of the Earth's climate to natural or anthropogenic changes is the radiative balance at the top of the atmosphere. Two classes of measurements may be undertaken: (1) a monitoring of the radiation balance over decade-long long time-scales, and (2) measurements designed to provide a sufficiently complete data set to validate or improve models. This paper discusses some of the important ingredients in obtaining such data, and presents a description of some candidate instrumentation for use on a small satellite. 23 refs.

19424 (LBL–31214) **Comparison of measurements of aerosol elemental carbon at Wrangel Island, USSR, and Barrow, Alaska.** Polissar, A.V. (AN SSSR, Moscow (USSR). Inst. Fiziki Atmosfery); Kapustin, V.N.; Hansen, A.D.A. Lawrence Berkeley Lab., CA (United States). Aug 1991. 7p. Sponsored by USDOE, Washington, DC (United States); National Oceanic and Atmospheric Administration, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9110357–1: European aerosol conference, Karlsruhe (Germany), 28-31 Oct 1991). Order Number DE92010295. Source: OSTI; NTIS; GPO Dep.

During the winter and spring seasons of 1989 and 1990, we collected samples of the background aerosol at Wrangel Island in the eastern Soviet Arctic. The samples were analyzed by optical transmission to determine the concentration of aerosol "black" carbon (BC), with results ranging from 5 to 167 nanograms per standard cubic meter. These results are compared with the continuous measurements at the NOAA/CMDL monitoring station at Barrow, Alaska for cases when meteorological trajectories connected the two locations with transit times of from one to two days. The preliminary results suggest that concentrations of aerosol BC are reduced at Wrangel relative to Barrow.

19425 (LIS–97) **Notes and demands on the safety of activated carbon filters at waste incineration plants subjected to the German Hazardous Incident Ordinance (12. BlmSchV).** Hansmann, G.; Wefers, H. Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany). 1991. 56p. (In German). Order Number DE92516792. Source: OSTI; NTIS (US Sales Only).

For many waste incineration plants, the emission limit values set in the 17th Ordinance for the Implementation of the German Law for Air Pollution Control and Noise Abatement of 1990 require additional measures for flue gas cleaning. One technique to keep the limit values for heavy metals, dioxins and furans is the adsorptive gas cleaning in an activated carbon filter. Such filters work by sorbent injection into a fluidised bed reactor or a flue gas duct followed by a fibre filter or as moving bed adsorber. This report contains notes and demands on the safety of activated carbon filters at waste incineration plants subjected to the German Hazardous Incident Ordinance (12. BlmSchV). Measures are shown to prevent and to limit the effects of fires, explosions and of toxic gas or dust emissions. Thus the report should assist the fulfilment of the safety duties according to the Hazardous Incident Ordinance. Furthermore it should help to produce, check and assess any necessary safety reports. (orig.).

19426 (NEI-DK–780) **SNOX system.** NEFO Vendsysselvaerket I/S, Vodskov (Denmark). [1991] 21p. (In Danish). Order Number DE92506309. Source: OSTI; NTIS (US Sales Only).

On May 23, 1984, the Danish government passed a law (no.251) on the reduction of sulphur dioxide emission. Since then a new law has been passed which also demands the reduction of nitrogen oxides. Total emission must be halved before the year 2005, this means that emission must be cleaned to the degree of 75%. The Danish electric power company "ELSAM" has constructed a "SNOX" system for flue gas cleaning to reduce emission of both sulphur dioxide and nitrogen oxides for a large Danish power station named "Vendsysselvaerket". This system is described in detail and the text is illustrated with diagrams and photographs. The advantages of the system, it is claimed, is that, in addition to the removal of SO_2 and NO_x , there is no waste water, no dust emission, NH_3 is the only additive, the waste products can be sold and it is robust and economical to operate. (AB).

19427 (NEI-DK–795) **Dispersion studies on Gran Canaria and Tenerife: Model calculations.** Thykier-Nielsen, S.; Mikkelsen, T. Risoe National Lab., Roskilde (Denmark). Nuclear Safety Research Dept.; Risoe National Lab., Roskilde (Denmark). Meteorology and Wind Energy. Dec 1991 32p. Order Number DE92506328. Source: OSTI; NTIS (US Sales Only).

The purpose was to evaluate dispersion model results calculated for two power plants to be build in the coastal zone on the Spanish islands Grand Canary and tenerife by the RISOe models LINCOM/RIMPUFF. The main objective was to quantitative estimate worst case scenarios of the ground level average concentration of SO_2 resulting from emissions of blocks of new projected power plants on these islands. Of particular relevance is the proximity of the main tourist areas, the immediate local populations and the effect of the air orne pollutants on both the extensive arable cultivation and the rare flora. Assessments showed maximum 2-hour ground level mean-concentrations in the vicinity of 340 μgrams/m^3, and daily-averaged dose ranging from 10 - 100 μgrams/m^3. The maximum ground level concentration were found near the power plants within distances of 1 to 3 km downwind. At longer ranges, out to 10 km or so, the topography of the islands significantly veered the mean flow and thereby the plumes, but according to our isoline calculations the modification of the flow did not give rise to secondary maxima in the mean concentration field. Higher 2- hour mean concentrations might occur during special meteorological conditions, but presumably this will only happen during fumigation, building wake down drafts and plume/hillside impingements. Higher concentrations,- some even likely to exceed the 700 $\mu g/m^3$ level, may occur during short periods at exposed locations and at locations near the power plant sites during transitional meteorology. (AB) 16 refs.

19428 (NEI-DK–799) **The reaction between sulphur dioxide and ammonia in flue gas.** Hjuler, K. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. Jul 1991 184p. Order Number DE92506339. Source: OSTI; NTIS (US Sales Only).

Formation of aerosols and scaling of process equipment and monitoring systems are examples of problems related to the use of ammonia in desulfurization and denitrification processes. The reaction between sulphur dioxide and ammonia in flue gas has been studied in simulated and real flue gases using 1.5-12.0 mm internal diameter laboratory plug flow reactors and flows ranging from 0.5-4.0 Nl/min. The reaction temperature, sulphur dioxide concentration and ammonia concentration was 40-80 deg. C, 60-1000 ppm and 120-2000 ppm, respectively. The water content of the gas was typically 6 vol-% and the oxygen content 5 vol-%. Diffusion of the reactants from bulk phase to the reactor wall had minor influence on the observed rate of reaction. The initiation step of the reaction is sensible to surface characteristics. Once initiated, no influence of the reactor construction material is observed, but temperature hysteresis phenomena appears. Formation of aerosols have not been indicated. An overall mechanism for the reaction involving two intermediary species in proposed, and a simple three parameter expression for the reaction rate was developed from the mechanism. The model may be applied in designing ammonia based dry or semi-dry desulphurization processes. A semi-dry application of ammonia for flue gas desulphurization was investigated. The application was interesting due to the possiblity of studying the effect of a relatively low reaction temperature, and of using various additives and materials. Procedures for flue gas sampling and continuous measurement of ammonia were developed for the simultaneous monitoring of sulphur dioxide and amonia concentrations in flue gases. (AB) 75 refs.

19429 (NEI-DK–800) **Sulphur capture in fluidized bed combusters.** Binderup Hansen, P.F. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. May 1991 251p. Order Number DE92506338. Source: OSTI; NTIS (US Sales Only).

An experimental study of the reactions related to sulphur capture by natural limestone during fluidized bed combustion is described. Experimental investigations were carried out in specially developed electrically heated laboratory scale fixed bed reactor. Under oxidizing conditions sulphur is captured as $CaSO_4$. Under reducing conditions in the presence of CO, sulphur is captured as CaS. When H_2 is used instead of CO as reducing agent the rate of reductive decomposition of formed $CaSO_4$ increases and no formation of CaS is observed. Using CH_4 neither reductive decomposition of $CaSO_4$ nor formation of CaS was observed. The mechanism explains the main reason for the temperature optimum observed for desulphurization in fluidized bed combusters which appears to be caused by the competition between sulphur capture and sulphur release, the latter of which becomes increasingly important at high temperature. The sulphur capacity of 14 European limestones were studied under oxidizing and alternating conditions. Fe_2O_3 lowers the sulphur capacity significantly under alternating conditions. Reduction in particle size seems to increase the SO_2 release due to CaS oxidation but decreases the emission of SO_2 due to reductive decomposition of $CaSO_4$. Both phenomenous may lead to a reduced flue gas desulphurization in real combusters. The influence of desulphurization on the nitrogen chemistry in fluidized bed combusters was studied qualitatively. CaS, is shown to be a strong catalyst for NO and N_2O reduction by CO. N_2O is oxidized to NO during the rapid and highly exothermal oxidation of CaS. (AB) 140 refs.

19430 (NEI-DK–804) **Testing of dust monitors at low concentrations.** Johansen, L.P. Danske Elvaerkers Forening, Copenhagen (Denmark). Kraftvaerkernes Miljoeudvalg, Stofemissionsgruppen. [1991] 57p. (In Danish). Order Number DE92506329. Source: OSTI; NTIS (US Sales Only).

Monitors which continually register dust concentration at a power plant in Studstrup, in Denmark, were tested in order to ascertain their suitability for measuring concentrations of less than 10 mg per cubic meter. The trade names of the monitors are Environnement beta-5, Sigrist KTNR-M-R21 and Sick RM 100. Each monitor proved to have a correlation coefficient larger than 97%. As the monitors reacted in exactly the same way it was concluded that they are all suitable for continuous measurement of dust concentrations of 3-15 mg per cubic meter (n,t). (AB).

19431 (NEI-DK–828) **Dioxin emission from vehicles.** Soegaard, N.; Grove, A. Dansk Teknologisk Inst., Taastrup (Denmark). Auto- og Motorteknik; Dansk Teknologisk Inst., Taastrup (Denmark). Miljoeteknik. Jan 1992 58p. (In Danish). Contract EM-1243/88-6. Order Number DE92506394. Source: OSTI; NTIS (US Sales Only). EFP-88.

The theoretical aspects of toxic emission from cars presented here are based on a perusal of relevant literature published in countries other than Denmark. Following this, results are given of an analysis of a vehicle's performance with regard to emission and dioxins, in the case of dioxins in relation to lead content and the amount of additives in the petrol used. Results show that the emission of dioxin does depend on the amount of additives in the petrol, yet it has not been possible to detect it in cases of normal additive content, but only in the case of provoked excess use of additives. It could not be proved that the use of a catalytic converter had any significant effect on the dioxin emission. International investigations show that diesel motors do not produce dioxin, and also that motors that utilize unleaded petrol only emit very small amounts of dioxin in comparison to those that use leaded petrol. The dioxin emission from the total Danish private-car fleet is claimed to be less than 400 g per year. (AB).

19432 (NEI-NO–198) **Radon in dwellings: Recommendations for measurements indoors and for investigations on building site.** SIS Raad. Statens Inst. for Straalehygiene, Oslo (Norway). 1991 19p. (In Norwegian). Order Number DE92627917. Source: OSTI; NTIS (US Sales Only); INIS.

An evaluation of methods for the radiation monitoring of radon in indoor air is given, together with guidelines for the investigation of building sites taking in consideration the radiation hazards from radon. 2 figs., 4 tabs.

19433 (NEI-NO–211) **Economics and the global environmental challenge.** Pearce, D. Fridtjof Nansens Inst., Lysaker (Norway). 1990 24p. Order Number DE92506548. Source: OSTI; NTIS (US Sales Only).

The problems of designing international agreements to meet the global environmental challenge are formidable. This paper has offered only the briefest of overviews of what is a major set of issues for immediate and future debate. The basic questions posed are highly problematic, namely what is an acceptable level and rate of global warming, and how we design an efficient structure of global incentives for cooperation. The answers will involve more imagination and vigor than the international community has shown so far. It is evident that many of the existing discussions are based on the belief that science alone can determine what is acceptable. That is false, and most probably dangerous in terms of the potential for wasting the resources of the world. Social scientists are also relevant to measuring impacts and computing the cost of global warming. But assessing impacts is only one aspect of the decision-making problem. Designing incentives is the remaining one. Humans are all too rational in their self-interest and it is this that will threaten international agreements, unless, of course, we use and manipulate self-interest to global advantage. That is the real global challenge. 36 refs., 4 tabs.

19434 (NUREG–0837-Vol.11-No.4) **NRC TLD Direct Radiation Monitoring Network: Quarterly progress report, October–December 1991.** Struckmeyer, R.; McNamara, N. Nuclear Regulatory Commission, King of Prussia, PA (United States).

Region I. Apr 1992. 319p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO.

This report presents the results of the Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network for the fourth quarter of 1991. It provides the ambient radiation levels measured in the vicinity of 75 sites throughout the United States. In addition, it describes the equipment used, monitoring station selection criteria, characterization of the dosimeter response, calibration procedures, statistical methods, intercomparison, and quality assurance program.

19435 (NUTEK-FBT–92-6) **Characterization of flue gases from wood fired boilers.** Karlsson, M.L. (Swedish National Testing and Research Institute, Boraas (Sweden)); Gustavsson, L. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). [1992]. 73p. (In Swedish). Project NUTEK-276-464. Order Number DE92506589. Source: OSTI; NTIS (US Sales Only).

The measurements were made on four small house boilers. Three of them were environmentally approved with improved combustion technology, while the fourth was a traditional boiler. Investigated parameters were: * CO, CO_2, NO_x and CH_x, * tar and dusts, * 12 volatile organic compounds (VOC), * polycyclic aromatic hydrocarbons, * chlorobenzenes and chlorophenols, * dioxins. Tar content fell below current limit value, 30 mg/MJ, in the approved boilers. The traditional boiler release was 30 times higher than those from the approved ones. Emission of NO_x was 60-76 mg/MJ for the traditional and 100-140 mg/MJ for the approved. Regarding VOC, the traditional boiler release was 2-4 times higher when ackumulator firing, but with direct firing there was no difference. (Numerous figs. and tabs.).

19436 (ORNL/CDIAC–46) **TRENDS 1991: A compendium of data on global change.** Boden, T.A.; Sepanski, R.J.; Stoss, F.W. (eds.). Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Dec 1991. 694p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ESD–3746). Order Number DE92011733. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3746.

This document is a source of frequently used global-change data. This second issue of the Trends series expands the coverage of sites recording atmospheric concentrations of carbon dioxide (CO_2) and methane (CH_4), and it updates records reported in the first issue. New data for other trace atmospheric gases have been included in this issue; historical data on nitrous oxide (N_2) from ice cores, modern records of atmospheric concentrations of chlorofluorocarbons (CFC-11 and CFC-12) and N_2O, and estimates of global estimates of CFC-11 and CFC-12. The estimates for global and national CO_2 emissions from the burning of fossil fuels, the production of cement, and gas flaring have been revised and updated. Regional CO_2 emission estimates have been added, and long-term temperature records have been updated and expanded. Data records are presented in four- to six-page formats, each dealing with a specific site, region, or emissions species. The data records include tables and graphs; discussion of methods for collecting, measuring, and reporting the data; trends in the data; and references to literature that provides further information. All data appearing in the document are available on digital media from the Carbon Dioxide Information Analysis Center.

19437 (ORNL/CDIAC–47) **Two long-term instrumental climatic data bases of the People's Republic of China.** Kaiser, D.P. Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Nov 1991. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NDP–039). Order Number DE92010378. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3747.

Two long-term instrumental data bases containing meteorological observations from the People's Republic of China (PRC) are described. These data sets were compiled in accordance with a joint research agreement signed by the United States Department of Energy (DOE) and the PRC Chinese Academy of Sciences (CAS) on August 19, 1987. CAS has provided records from 265 stations, partitioned into networks of 60 and 205 stations which each provide good geographical coverage of the PRC. The 60-station network data contain monthly measurements of barometric pressure, air temperature, precipitation amount, relative humidity, sunshine duration, cloud amount, wind direction and speed, and number of days with snow cover. Detailed station histories are presented for all 60 stations. The 205-station network data contain monthly mean temperatures and monthly precipitation totals; however, station histories are not currently available. Sixteen stations from these data sets (13 from the 60-station, 3 from the 205-station) have temperature and/or precipitation records which begin prior to 1900, whereas the remaining stations began observing in the early to mid 1900s. Records from the 262 stations extend through 1988; the remaining three station records extend through the early 1980s. These data can be used in defining regional climate changes, establishing relationships between regional and large-scale climates, and in studying the climatic impacts of urbanization and increased concentrations of greenhouse gases. Additional uses could include examining impacts of periodic events such as volcanic eruptions or the El Nino/Southern Oscillation (ENSO). These data sets represent the most comprehensive, long-term instrumental Chinese climate data presently available.

19438 (PNL–8049) **1988 Wet deposition temporal and spatial patterns in North America.** Simpson, J.C.; Olsen, A.R.; Bittner, E.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 198p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011509. Source: OSTI; NTIS; GPO Dep.

The focus of this report is on North American wet deposition temporal patterns from 1979 to 1988 and spatial patterns for 1988. It is the third in a series of reports that investigate the patterns of annual precipitation-weighted average concentration and annual deposition for nine ion species: hydrogen, sulfate, nitrate, ammonium, calcium, chloride, sodium, potassium, and magnesium. Mosaic maps, based on surface estimation using kriging, display concentration and deposition spatial patterns of pH, hydrogen, sulfate, nitrate, ammonium, and calcium ion species for 1988 annual, winter, and summer periods. Temporal pattern analyses use a subset of 35 sites over a 10-year (1979–1988) period and an expanded subset of 137 sites, with greater spatial coverage, over a 7-year (1982–1988) period. The 10-year period represents the longest period with wet deposition monitoring data available that has a sufficient number of sites with data of known quality to allow a descriptive summary of annual temporal patterns. Sen's median trend estimate and Kendall's seasonal tau (KST) test are calculated for each ion species concentration and deposition at each site in both subsets.

19439 (PNL-SA–20399) **Reducing greenhouse gas emissions in Czechoslovakia.** Kostalova, M. (Office of International Economic Corp., Ministry of Foreign Affairs, Prague (Czechoslovakia)); Suk, J.; Kolar, S. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 23p. Sponsored by Environmental Protection Agency, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012354. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper are presented important findings on the potential for energy conservation and carbon emissions reduction over the coming decades in Czechoslovakia. The authors describe the state of the energy use in Czechoslovakia today and the measures required to transform its energy system to a market-based economy oriented towards the environmental goal of decreased energy intensity. This work furthers our understanding of the need for energy efficiency in the newly forming market economies of East and Central Europe. This paper is part of a series of country studies sponsored by the Global Climate Division of the Office of Policy, Planning, and Evaluation, United States Environmental Protection Agency (EPA). We have completed similar studies in Canada, the former Soviet Union, France, Hungary, Italy, Japan, Poland the United Kingdom, and the United States. Research is currently underway or planned in Bulgaria, Romania, and Ukraine.

19440 (SCPRI-RM–3-1991) **Monthly results of measurements, march 1991, with supplement related to 1991 first quarter.** Service Central de Protection contre les Rayonnements

Ionisants, 78 - Le Vesinet (France). Mar 1991. 60p. (In French). Order Number DE92517861. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables.

19441 (SCPRI-RM-9-1991) **Monthly results of measurements, september 1991, with supplement related to 1991 third quarter.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1991. 55p. (In French). Order Number DE92517862. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables.

19442 (SFB-210/T-67) **On the parameterization of an admixture exchange between the planetary boundary layer and the free atmosphere.** Zilitinkevich, S.S. (Academy of Sciences, Leningrad (USSR). Inst. of Limnology). Karlsruhe Univ. (T.H.) (Germany). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke. Aug 1990. 7p. Order Number DE92515868. Source: OSTI; NTIS (US Sales Only).

The problem of an admixture exchange between the planetary boundary layer (PBL) and the free atmosphere (FA) is considered, accounting for the blocking effect of the stably stratified intermediate layer, the 'atmospheric thermocline' (AT), in frames of a model based on the budget equations for the vertically averaged admixture concentrations. The most simple parameterization of the admixture fluxes through the PBL/AT and AT/FA interfaces produced by the low frequency mesoscale motions is suggested. (orig.).

19443 (UCRL-52000-91-12) **Energy and technology review, December 1991.** Sefcik, J.A.; de Vore, L.; Gleason, K.; Kroopnick, H.; McGregor, C.; Stanford, N.M. (eds.). Lawrence Livermore National Lab., CA (United States). [1991]. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013595. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory was established in 1952 to do research on nuclear weapons and magnetic fusion energy. Since then, we have added other major programs, including laser fusion and laser isotope separation, biomedical and environmental science, strategic defense, and applied energy technology. These programs, in turn, require research in basic scientific disciplines, including chemistry and materials science, computer science and technology, engineering, and physics. Energy and Technology Review is published monthly to report on unclassified work in all our programs. Various topics concerning Desert Storm are presented in this issue: (1) The Oil/Gas Separator: A New Cap for Quenching Oil-Well Fires; (2) Airborne Detection of Buried Minefields; (3) Assessing the Hazardous Effects of Airborne Particles During and After Operation Desert Storm.

19444 (UCRL-JC-109830) **Daily dispersion model calculations of the Kuwait oil fire smoke plume.** Ellis, J.S. (Lawrence Livermore National Lab., CA (United States)); Foster, C.S.; Foster, K.T.; Sullivan, T.J.; Baskett, R.L.; Nasstrom, J.S.; Schalk, W.W. III; Greenly, G.D. Lawrence Livermore National Lab., CA (United States). 26 Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC08-88NV10617. (CONF-9206114-7: Annual meeting of the Air and Waste Management Association (AWMA), Kansas City, MO (United States), 21-26 Jun 1992; EGG-10617-4129). Order Number DE92011969. Source: OSTI; NTIS; GPO Dep.

The Atmospheric Release Advisory Capability (ARAC) provided daily forecasts of the position and spatial character of the Kuwait oil fire smoke plume to the NSF-coordinated research aircraft missions in the Persian Gulf. ARAC also provided daily plume dispersion products to various nations in the Persian Gulf region under the auspices of the World Meteorological Organization for a period of nearly 5 months. Forecasted three dimensional winds were provided to ARAC from the US Air Force Global Weather Central's Relocatable Wind Model (RWM). The RWM winds were spaced approximately 90 km in the horizontal and were located at the surface, 1000 ft., 2000 ft, 5000 ft and every 5000 ft up to 30,000 ft elevation. The forecast periods were 0, 6, 24, and 36 hours from both 0000 and 1200 UTC. A wind field model (MATHEW) corrected for terrain influences on the wind. The smoke plume was dispersed using a three dimensional particle-in-cell code (ADPIC) with buoyant plume rise capability. Multiple source locations were used to represent the burning oil fields. Improved estimates of the source term and emission factors for the smoke were incorporated into the ADPIC calculations as the field measurement data were made available.

19445 (UCRL-LR-105199-91) **Environmental Technology Program: Annual report, FY91.** Lawrence Livermore National Lab., CA (United States). 2 Jan 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012613. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory's Environmental Technology Program was organized in FY90 to research, develop, demonstrate, test, and evaluate innovative technologies for reducing the costs and increasing the effectiveness of environmental restoration and waste management. During FY91 the program was funded primarily by the Office of Technology Development of the US Department of Energy's Office of Environmental Management. The program works closely with environmental restoration and waste management projects funded by DOE's Office of Environmental Restoration and Office of Waste Operations. This report introduces the scope, participating organizations, and interfaces of the Environmental Technology Program, and gives an overview of technical progress in FY91.

19446 (VTT-TIED-1244) **Emission measurement in energy production: High-powered sampling apparatus for organic compounds.** Tirkkonen, T. (Technical Research Centre of Finland, Espoo (Finland). Chemical Lab.); Laukkarinen, A.; Hoffren, H.; Mroueh, U.M. Technical Research Centre of Finland, Espoo (Finland). May 1991. 40p. (In Finnish). Order Number DE92506497. Source: OSTI; NTIS (US Sales Only).

The project is financed by the Finnish Ministry of Trade and Industry.

The Chemical Laboratory of Technical Research Centre of Finland has developed and built a fast high-powered sampling apparatus for organic compounds from flue gases.

19447 (VTT-TIED-1309) **Reduction of heavy metal emissions: Technical-economic study.** Aunela, L. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation); Larjava, K. Technical Research Centre of Finland, Espoo (Finland). Nov 1991. 79p. (In Finnish). Order Number DE92506500. Source: OSTI; NTIS (US Sales Only).

Heavy metal concentrations in tne flue gases of metal and building material industries and energy production exceeds the German emission standards unless efficient cleaning devices are installed. Particle separators are mainly used to achieve reductions in heavy metal emissions. Some of the heavy metals, most of the mercury and a variable but generally small proportion of other metals, occur in flue gases as vapours, which have to be separated by special methods. The most effectively performing particle separators, i.e. bag and electrical filters, are suitable for the removal of heavy metals, since the metals are concentrated in the treatment equipment into particles that are most difficult to remove. Vapourous metals are removed by adsorbing them on a solid material or by absorbing them into a liquid. The end-product of the adsorption process is a solid, whereas the end-product of the absorption process is a liquid, unless the water is vaporized. Generally, heavy metals are removed from flue gases primarily by reducing emissions (usually particles) of some other emission component. The costs associated with reduced heavy metal emissions have been examined using example cases. Because treatment measures are not generally targeted directly at heavy metals, the costs associated with these are difficult to assess. The acquisition costs of bag filters, which are almost always able to reduce the overall concentration of the most harmful heavy metals in particulate phase to well below 1 mg/m^3, are FIM 50- 100m^3/h. The acquisition costs of electrical filters, which are generally able to reduce the concentration of the heavy metals to 1 mg/m^3 or below, vary between FIM 30 000-80 000/MW, depending on the capacity of the energy production plant.

19448 (VTT-TIED–1313) **Emission model of energy production and industry for Finland.** Lehtilae, A. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Pirilae, P. Technical Research Centre of Finland, Espoo (Finland). Dec 1991. 95p. (In Finnish). Order Number DE92506489. Source: OSTI; NTIS (US Sales Only).

Energy conversion and energy use are important sources of atmospheric pollution. EFOM-ENV is a modelling tool which can be used to describe the whole energy system, the emissions produced in it, and the available emission control measures. In the past few years EFOM-ENV models have been taken into widespread use all over Europe, and the models have proven to give a good basis for international cooperation in emission control analysis. An FFOM-ENV model is a dynamic linear optimization model. It can be used to analyse the cost-effectiveness of fuel switching, technological substitution, energy conservation, efficiency improvements and emission control technologies in the search for optimal strategies to reduce emissions within one country. All kinds of emissions can simultaneously be taken into consideration in the analysis. Most useful result, however, have been obtained in studies concerning on one hand the acidificating sulphur and nitrogen oxides and on the other hand the greenhouse gases, particularly carbon dioxide. The results from the model applications describe the optimal means to reach given emission targets in terms of developments in the energy system as well as direct control measures.

19449 **Means for separating out noxious substances from gases and exhaust gases, a process of making said means and a process.** Suchenwirth, H. 2 Nov 1991. Filed date 2 May 1990. Canada Patent patent application 2015974. 17p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method for removing noxious substances from gases is provided which is suited for treating gases and exhaust gases from industrial plants, power plants, refuse incinerating plants, and combustion plants. In the first stage of the method, calcium hydroxides are produced which contain water-soluble salts of sulfur compounds such as mercaptans, sulfides, polysulfides, polythionates, and thiosulfates or elementary sulfur which is used in combination with surface active substances. The second stage consists of reacting the resulting pollutant removal product with volatile pollutants such as heavy metals contained in the gas being treated. The contaminants are then separated out of the gas stream. The pollutant removal product can be produced by adding the sulfur compounds to calcium oxide during slaking, to the slaking water, or to calcium hydroxide subsequent to slaking. The pollutant removal product is particularly useful for removing metals including Hg, As, Cd, Tl, Sb, and Pb at temperatures ranging from 20 to 400°C. For this purpose, the product is blown as powder into the gas stream, and the resultant substances are separated by means of fabric filters. Upon addition of surface active substances, volatile organic pollutants are removed simultaneously with the inorganic pollutants. Experiments are described to illustrate the invention.

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Refer also to citation(s) 17731, 17867, 17868, 17912, 17919, 17923, 17924, 17927, 17938, 17940, 17943, 17948, 17953, 17967, 17972, 17979, 17980, 17986, 17997, 18017, 18052, 18053, 18071, 18086, 18087, 18089, 18096, 18097, 18102, 18103, 18104, 18113, 18202, 18224, 18225, 18257, 18281, 18559, 18585, 18601, 18767, 19391, 19393, 19397, 19398, 19405, 19407, 19410, 19421, 19422, 19440, 19441, 19445, 19918, 19921, 19922, 19923, 19936, 19954, 20441, 20505

19450 (AECL–8905) **A downhole colun technique for field measurememnt of transport parameters.** Champ, D.R.; Moltyaner, G.L.; Young, J.L.; Lapcevic, P. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Oct 1985. 48p. Order Number DE92625794. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents a new method for the characterization of dispersive and adsorptive properties of natural sedimentary deposits at a field site in the Perch Lake Basin using a downhole technique. The potential capabilities of the proposed method were evaluated by conducting a dual-tracer test in a series of downhole field columns using non-reactive (^{3}H) and reactive (^{85}Sr) tracers. The observed breakthrough curves were analysed using linear and non-linear mass transport equations. The dispersivity values obtained by analysing ^{3}H (range 0.2-1.1 cm) are in good agreement with those reported for ^{131}I radial injection experiment at the same site (range 0.4-1.5 cm). The distribution coefficient (Kd^{Sr}) values obtained from analysis of breakthrough curves at four depths using the linear equilibrium model ranged from 6.22 to 7.39 mL.g^{-1}. These values are in good agreement with those obtained by separation of pore waters from sediments (5.0-6.6 mL.g^{-1}) and half of those obtained by batch experiments on core sediments (12.8-14.9 mL.g^{-1}). These values compare favorably with the Kd^{Sr} determined for Sr migrating in a 25-year-old radioactive waste plume (mean of 10 mL.g^{-1}) at a nearby site. The model identification problem was addressed by constructing linear and non-linear equilibrium transport models. The non-linear models based upon Freundlich and Langmuir isotherms showed some improvement over the linear model in fitting experimental data. It was concluded, however, that for simulating radio-strontium behaviour.

19451 (AECL–10370) **Fracture detection and groundwater flow characterization in poorly exposed ground using helium and radon in soil gases.** Gascoyne, M.; Wuschke, D.M. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. May 1991. 80p. Order Number DE92625809. Source: OSTI; NTIS (US Sales Only); INIS.

Radon and helium in soil gases have been used to identify locations of groundwater discharge and the presence of fractures outcropping beneath overburden in two areas near the Underground Research Laboratory (URL), Lac du Bonnet, Manitoba, Canada. In particular, groundwater discharge from a known, inclined fracture zone at the URL was clearly identified by a helium excess in overlying soil gases. A model was developed to describe gas phase flow in bedrock and overburden at this location, from gas injection in an adjacent borehole. Predictions were made of gas transport pathway and breakthrough time at the surface, in preparation for a gas injection test.

19452 (AECL–10384) **The mass transport of radionuclides in a multilayered medium.** Garisto, N.C.; LeNeveu, D.M.; Garisto, F. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment; Ontario Hydro, Toronto, ON (Canada). Jan 1992. 40p. (COG–91-297.). Order Number DE92625793. Source: OSTI; NTIS (US Sales Only); INIS.

This document describes the mathematical formalism for calculating the rate of mass transport across interfaces in a multilayered medium for radionuclides in a decay chain. Two numerical algorithms have been developed, both based on Laplace transport techniques: a direct solution for concentrations and fluxes in a two-layer medium; and, an approximate solution based on a response function for the mass transport across a finite layer adjacent to a semi-infinite layer. A comparison of the two algorithms is presented. Results of sample calculations for a multilayered medium are also reported and compared with results based on the mass-transfer coefficient approximation.

19453 (ANL–91/3) **Argonne National Laboratory–East site environmental report for calendar year 1990.** Golchert, N.W.; Duffy, T.L.; Moos, L.P. Argonne National Lab., IL (United States). Jul 1991. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012282. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the results of the environmental protection program at Argonne National Laboratory-East (ANL) for 1990. To evaluate the effects of ANL operations on the environment, samples of environmental media collected on the site, at the site boundary, and off the ANL site were analyzed and compared to applicable guidelines and standards. A variety of radionuclides was measured in air, surface water, groundwater, soil, grass, bottom sediment, and milk samples. In addition, chemical constituents in surface water, groundwater, and ANL effluent water were analyzed. External penetrating radiation doses were measured and the potential for radiation exposure to off-site population groups was estimated. The results of the surveillance program are interpreted in terms of the origin of the radioactive and chemical substances (natural, fallout, ANL, and other) and are compared with applicable environmental quality standards. A US Department of Energy (DOE) dose calculation methodology, based on International Commission on Radiological Protection (ICRP) recommendations, is used in this report. The status of ANL environmental protection activities with respect to the various laws and regulations which govern waste handling and disposal is discussed. This report also discusses progress being made on environmental corrective actions and restoration projects from past activities.

19454 (ANL/CP-75281) **Application of ground-penetrating radar at McMurdo Station, Antarctica.** Stefano, J.E. Argonne National Lab., IL (United States). [1992]. 17p. Sponsored by National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9204110-1: 1992 Hazardous Materials Control Research Institute federal environmental restoration conference, Vienna, VA (United States), 15-17 Apr 1992). Order Number DE92010902. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory initiated a site investigation program at McMurdo Station, Antarctica, to characterize environmental contamination. The performance and usefulness of ground-penetrating radar (GPR) was evaluated under antarctic conditions during the initial site investigation in January 1991. Preliminary surveys were successful in defining the contact between reworked pyroclastic material and in the prefill, undisturbed pyroclastics and basalts at some sites. Interference from radio traffic at McMurdo Station was not observed, but interference was a problem in work with unshielded antennas near buildings. In general, the results of this field test suggest that high-quality, high-resolution, continuous subsurface profiles can be produced with GPR over most of McMurdo Station.

19455 (ANL/CP-75814) **Effects of solution pH and complexing reagents on the desorption of radionuclides in soil.** Wang, Yug-Yea; Yu, C. Argonne National Lab., IL (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9205148-1: Mid-America Chinese professional annual convention, Itasca, IL (United States), 29-31 May 1992). Order Number DE92013062. Source: OSTI; NTIS; GPO Dep.

In contaminated soils, radionuclides such as uranium and/or thorium may be associated with different chemical species on soil surfaces or inside soil grains with consequent differences in leachability and mobility. Chemical species in contacting solutions can react with soil contaminants by dissolution, ion exchange, or complexation to release contaminants from the soil to the solution. It is important to understand the effect of chemical species in solution for investigating the distribution of uranium and thorium between the soil and the solution under desorption conditions. In this work, the effects of the solution pH and the complexing reagents on the desorption of uranium and thorium under saturated equilibrium conditions were investigated.

19456 (ANL/ESD/TM-26) **Documentation of the Range 8C rehabilitation demonstration project at Hohenfels Training Area, West Germany.** Zellmer, S.D.; Hinchman, R.R.; Carter, R.P.; Severinghaus, W.D.; Lacey, R.M.; Brent, J.J. Argonne National Lab., IL (United States). Energy Systems Div. Mar 1987. 105p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92013298. Source: OSTI; NTIS; GPO Dep.

Continued and intensive tactical training for the last 35 years at the Hohenfels Training Area (HTA), Federal Republic of Germany, has resulted in extensive environmental damage and reduced training realism. The US Corps of Engineers Construction Engineering Research Laboratory is developing an Integrated Training Area Management (ITAM) Program for the Seventh Army Training Command for use at HTA. Argonne National Laboratory was asked to assist in one element of the ITAM program, a training range rehabilitation demonstration project. The rehabilitation project was begun in 1986 on a 62-ha watershed that included about 16 ha of meadow with training damage typical of HTA. On the basis of amount of plant ground cover, type and degree of erosion, and soil properties, 10 rehabilitation prescriptions were developed to reestablish plant cover, control erosion, and improve training realism. Prescriptions were installed by a local contractor in September 1986. A monitoring program is under way to determine the effectiveness of this effort. Results and experience gained from this project will be used in the ITAM program and for rehabilitation training courses conducted at HTA.

19457 (ANL/RP-75855) **Derivation of uranium residual radioactive material guidelines for the Ventron site.** Loureiro, C.; Yu, C.; Jones, L. Argonne National Lab., IL (United States). Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012684. Source: OSTI; NTIS; INIS; GPO Dep.

Residual radioactive material guidelines for uranium were derived for the Ventron site in Beverly, Massachusetts. This site has been identified for remedial action under the Formerly Utilized Sites Remedial Action Program of the US Department of Energy (DOE). The derivations for the single radionuclides and the total uranium guidelines were based on the requirement that the 50-year committed effective dose equivalent to a hypothetical individual who lives or works in the immediate vicinity of the Ventron site should not exceed a dose of 100 mrem/yr following remedial action. The DOE residual radioactive material guideline computer code, RESRAD, which implements the methodology described in the DOE manual for implementing residual radioactive material guidelines, was used in this evaluation.

19458 (BfS-ISH-155/91) **Investigations into the transfer of cesium 137 and strontium 90 in selected exposure pathways. Final report.** Roemmelt, R.; Hiersche, L.; Wirth, E. Bundesamt fuer Strahlenschutz, Neuherberg (Germany). Inst. fuer Strahlenhygiene; Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany). Dec 1991. 91p. (In German). Contract BMU St.Sch 1033. Order Number DE92517151. Source: OSTI; NTIS (US Sales Only); INIS.

This research project investigates the behaviour of radiocesium and strontium 90 in natural conifer forest sites and derives corresponding transfer factors for radioecological calculations. As a point of particular interest the question was investigated in how far the requirements of the different mushroom species and the properties of the forest soil bear on the dynamics and transfer rate of radiocesium and strontium 90. To complement the investigations, autotrophic plants were included. The results of these studies are compared with the behaviour of the same radionuclides on farmland. The differences are discussed. (orig./HP).

19459 (CONF-9103215-, pp. 64-69) **Wood ash disposal and utilization.** Campbell, A.G. (Univ. of Idaho, Moscow (United States)). USDOE Bonneville Power Administration, Portland, OR (United States). PNW and Alaska Bioenergy Program; Idaho Univ., Moscow, ID (United States). Dept. of Forest Products; Idaho Dept. of Water Resources, Boise, ID (United States). [1991]. From Small-scale bioenergy alternatives for industry, farm, and institutions: a user's perspective; Coeur d'Alene, ID (United States); 18-21 Mar 1991. In *Small-scale bioenergy alternatives for industry, farm, and institutions: A user's perspective.* 219p. Order Number DE92005481. Source: OSTI; NTIS; INIS.

Wood ash is becoming a major disposal problem to the forest products industry as solid waste regulations become more stringent and as landfill costs escalate. The objective of this paper is to present information on wood ash that can be used to evaluate disposal and utilization alternatives. This paper reviews the literature on the chemical and physical properties of ash, methods of disposal and utilization, land application practices, and regulations concerning disposal. Wood ash has been used for centuries as a source of potash and lime for agricultural fields. Based on the properties of wood ash and the disposal alternatives, land application appears to be a safe, relatively simple and economical method for ash disposal. For example, several ash producers in the Northeast and Northwest currently land apply wood ash based on the liming requirements of the soil. Wood ash is a valuable liming agent and soil amendment which should be recycled back to the land rather than being concentrated and buried in a landfill.

19460 (CONF-9109234–Absts.) **Fourth Tennessee water resources symposium: Extended abstracts.** Sale, M.J.; Presley, P.M. (comps.). Oak Ridge National Lab., TN (United States). [1991]. 183p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); Tennessee Valley Authority, Knoxville, TN (United States); Geological Survey, Reston, VA (United States); Tennessee Technological Univ., Cookeville, DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE92011935. Source: OSTI; NTIS; INIS; GPO Dep.

The annual Tennessee Water Resources Symposium was initiated in 1988 as a means to bring together people with common interests in the state's important water-related resources at a technical, professional level. Initially the symposium was sponsored by the American Institute of Hydrology and called the Hydrology Symposium, but the Tennessee Section of the American Water Resources Association (AWRA) has taken on the primary coordination role for the symposium over the last two years and the symposium name was changed in 1990 to water resources to emphasize a more inter-disciplinary theme. This year's symposium carries on the successful tradition of the last three years. Our goal is to promote communication and cooperation among Tennessee's water resources professionals: scientists, engineers, and researchers from federal, state, academic, and private institutions and organizations who have interests and responsibilities for the state's water resources. For these conference proceedings, individual papers are processed separately for the Energy Data Base.

19461 (CONF-920444–24) **Solubilization and biodegradation of hydrophobic organic compounds in soil/aqueous systems with nonionic surfactants.** Edwards, D.A.; Laha, S.; Liu, Zhongbao; Luthy, R.G. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Civil Engineering. [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90303. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92011550. Source: OSTI; NTIS; GPO Dep.

Nonionic surfactants may strongly interact with hydrophobic organic compounds (HOCs), soil, and microorganisms in soil/aqueous systems. These interactions affect the potential for surfactant-facilitated HOC transport in soil and groundwater systems, and the feasibility of engineered surfactant cleanup of contaminated sites (McCarthy and Wober, 1991). At sufficiently high bulk liquid concentrations at 25 C, most nonionic surfactants form regular micelles in single-phase solutions, whereas certain surfactants, such as $C_{12}E_4$, may form bilayer lamellae or other types of aggregates in more complex two-phase solutions. The critical concentrations for the onset of micelle and aggregate formation are termed the critical micelle concentration (CMC) and the critical aggregation concentration (CAC), respectively. Important changes occur in surfactant sorption, surfactant solubilization of HOCs, and microbial mineralization of HOCs in the presence of nonionic surfactants at or near these critical surfactant concentrations.

19462 (CONF-920444–25) **Effects of nonionic surfactants on the microbial mineralization of phenanthrene in soil-water systems: [Quarterly report].** Laha, S.; Luthy, R.G. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Civil Engineering. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90303. From American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992. Order Number DE92011551. Source: OSTI; NTIS; GPO Dep.

The purpose of the work reported in this paper was to determine whether the inhibitory effect on microbial degradation of phenanthrene was specific to the nonionic surfactants used previously, i.e., the alkylethoxylate and alkylphenol ethoxylate surfactants. Thus, a number of nonionic surfactants of varying structures and properties were selected for further investigation. In addition, several tests were performed to verify results from earlier experiments.

19463 (CONF-9205144–1) **Dispersal of radioactivity by wildlife from contaminated sites in a forested landscape.** Garten, C.T. Jr. Oak Ridge National Lab., TN (United States). 27 Mar 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Dynamic behavior of radionuclides in forests; Stockholm (Sweden); 18-22 May 1992. Order Number DE92011774. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) is located within the Ridge and Valley physiographic province of eastern Tennessee (USA). This area is characterized by deciduous forests dominated by hardwood and mixed mesophytic tree species. Wildlife populations have access to some radioactively contaminated sites at ORNL, and contaminated animals or animal nests within the Laboratory's boundaries have been found to contain on the order of 10^{-12} to 10^{-6} Ci/g of ^{90}Sr or ^{137}Cs, and trace amounts of other radionuclides (including transuranic elements). Theoretical calculations indicate that nanocurie levels of ^{90}Sr in bone can arise from relatively small amounts (1%) of contaminated browse vegetation in a deer's diet. Measures that have been undertaken at ORNL to curtail the dispersal of radioactivity by animals are briefly reviewed.

19464 (CONF-9206114–6) **Nitrogen deposition to forest ecosystems: Forms, regional inputs, and effects.** Hanson, P.J.; Turner, R.S. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual meeting of the Air and Waste Management Association (AWMA); Kansas City, MO (United States); 21-26 Jun 1992. Order Number DE92011773. Source: OSTI; NTIS; GPO Dep.

The transfer of anthropogenically produced compounds from the atmosphere to vegetation has been identified as a possible causal factor leading to changes in natural ecosystems. This "nitrogen loading" is the combined result of the wet deposition of nitrate and ammonium ions in precipitation together with the dry deposition of N-containing particles and gaseous nitrogen compounds. This paper identifies the types and characteristics of reactive nitrogen compounds likely to be deposited to forest ecosystems, summarizes total nitrogen deposition to selected locations in North America and Europe, and discusses the potential direct and indirect effects that nitrogen deposition might be having on terrestrial ecosystems. In addition, the current status of the "critical load" concept for nitrogen deposition is addressed.

19465 (DOE/DP–0099T) **Augmented evaluation of soil contamination at the Savannah River Site outside Building 772-1F.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Safety Diagnostic Div. Jul 1991. 55p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92011738. Source: OSTI; NTIS; GPO Dep.

Radioactive contamination of soil adjacent to the outside south wall of Building 772-1F (a laboratory facility) at the Savannah River Site (SRS) was reported to the Department of Energy (DOE) Headquarters on April 24, 1991. The soil was contaminated as a result of leaks in the piping and in the secondary containment trench of the laboratory liquid-waste drainage system inside Building 772-1F. Contamination in storm drains outside the building was also detected. Because of the potential safety implications of the leaks and contamination, the Office of Self-Assessment and Emergency Management (DP-9) formed an Augmented Evaluation Team (AET) for an on-site diagnostic assessment. The AET was composed of staff from Defense Programs (DP-9 and DP-60), DOE Field Office, Savannah River (SR), a specialist from DOE Field Office, Idaho (ID), a consultant provided by the Nuclear Systems Safety Program of the Lawrence Livermore National Laboratory. This report discusses the AET findings.

19466 (DOE/EA–0501) **Evaporation Basin Test Reactor Area, Idaho National Engineering Laboratory: Environmental assessment.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). Dec 1991. 28p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012192. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-0501, on the construction and operation of the proposed Evaporation Basin at the Test Reactor Area (TRA) at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. Based on the analyses in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement (EIS) is not required, and the Department is issuing this Finding of No Significant Impact.

19467 (DOE/EA–0545) **Environmental assessment for the building 235 ion accelerator at the Lawrence Livermore National Laboratory.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Dec 1991. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012190. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Assessment (EA) considers the environmental effects of the operation of a commercially manufactured 4.0-MV ion accelerator in Building 235 at Lawrence Livermore National Laboratory (LLNL), Livermore site. Modifications to Building 235 are also addressed. Although impacts outside the facility are discussed most of the potential effects discussed in this EA are health and safety concerns inside the facility because a small, properly-shielded, commercial 4-MV ion accelerator has negligible impact outside the facility. As a result, the discussion of effects focuses on the area immediately adjacent to the accelerator.

19468 (DOE/EA–0547) **Environmental Assessment for install calibration laboratory, Building 12-52B, Pantex Plant, Amarillo, Texas.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Oct 1991. 8p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012188. Source: OSTI; NTIS; GPO Dep.

This Environmental Assessment (EA) has been prepared pursuant to implementing regulations to the National Environmental Policy Act (NEPA), which requires federal agencies to assess the environmental impacts of a proposed action to determine whether that action requires the preparation of an Environmental Impact Statement (EIS) or if a Finding of No Significant Impact (FONSI) can be issued. NEPA requires that an EA provide an interdisciplinary review of the proposed action in order to identify possible preferable alternatives and to identify mitigative measures that will prevent environmental impacts. If it is determined that the proposed action will have unavoidable significant environmental impact, then an EIS shall be prepared. The proposed project is for design and installation of a self-contained Modular Gage Calibration Laboratory in Building 12-52B at Pantex Plant, Amarillo, Texas. The operating contractor of Pantex Plant has been directed by the Sandia Laboratory at Albuquerque to acquire facilities capable of close temperature and humidity control for calibration of gages and tooling in support of production operations for weapons programs.

19469 (DOE/ER/13747–11) **Depositional and diagenetic history of the Edgecliff reefs (Middle Devonian Onondaga Formation of New York and Ontario): Final report.** Wolosz, T.H. State Univ. of New York, Plattsburgh, NY (United States). Center for Earth and Environmental Sciences. [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13747. Order Number DE92011128. Source: OSTI; NTIS; GPO Dep.

The study of the depositional history of the Edgecliff reefs is complete. Major results include: the identification of the Edgecliff and its reefs as the product of carbonate deposition in a temperate water environment, modes of reef growth, description of the nature of pinnacle reefs, and the basinal dynamics and distribution of pinnacle reefs. A trend was found of increasing number and size of stromatoporoids westwards from the vicinity of Albany, NY (where they are rare and small) to Hagarsville, Ontario, Canada (where they are common and large) due to the assumed solar warming of coastal currents flowing from east to west supports this hypothesis. Further evidence of this warming includes the first appearance of algae (Rothpletzella) in the vicinity of the LeRoy bioherm, LeRoy, NY. Carbon and oxygen isotopic analyses of brachiopods from the Edgecliff further support a cool water model for reef deposition.

19470 (DOE/ER/60247–T1) **Annual dynamics within the active layer: Annual progress report, March 15, 1990–March 14, 1991.** Alaska Univ., Fairbanks, AK (United States). Water Research Center. [1991]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60247. Order Number DE92013520. Source: OSTI; NTIS; INIS; GPO Dep.

We have continued our meteorological and hydrologic data collection in support of our process-oriented research. The six years of data collected to date is unique in its scope and continuity in a North Hemisphere Arctic setting. This valuable data base has allowed us to further our understanding of the interconnections and interactions between the atmosphere/hydrosphere/biosphere/lithosphere. The increased understanding of the heat and mass transfer processes has allowed us to increase our model-oriented research efforts. Examples of applications are the following. (1) Spring snowmelt on the North Slope of Alaska is the dominant hydrologic event of the year. This event provides most of the moisture for use by vegetation in the spring and early summer period. The mechanisms and timing of snowmelt are important factors in predicting runoff, the migrations of birds and large mammals and the diversity of plant communities. It is important globally due to the radical and abrupt change in the surface energy balance over vast areas. (2) We were able to explore the trends and differences in the snowmelt process along a transect from the Brooks Range to the Arctic Coastal plain. Snowpack ablation was monitored at three sites. These data were analyzed along with meteorologic data at each site. The initiation of ablation was site specific being largely controlled by the complementary addition of energy from radiation and sensible heat flux.

19471 (DOE/ID–12123) **Managing soil moisture on waste burial sites.** Anderson, J.E. (Idaho State Univ., Pocatello, ID (United States). Dept. of Biological Sciences); Ratzlaff, T.D.; Nowak, R.S.; Markham, O.D. USDOE Idaho Field Office, Idaho Falls, ID (United States). Nov 1991. 22p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012364. Source: OSTI; NTIS; INIS; GPO Dep.

Shallow land burial is a common method of disposing of industrial, municipal, and low-level radioactive waste. The exclusion of water from buried wastes is a primary objective in designing and managing waste disposal sites. If wastes are not adequately isolated, water from precipitation may move through the landfill cover and into the wastes. The presence of water in the waste zone may promote the growth of plant roots to that depth and result in the transport of toxic materials to above-ground foliage. Furthermore, percolation of water through the waste zone may transport contaminants into ground water. This report presents results from a field study designed to assess the the potential for using vegetation to deplete soil moisture and prevent water from reaching buried wastes at the Idaho National Engineering Laboratory (INEL). Our results show that this approach may provide an economical means of limiting the intrusion of water on waste sites.

19472 (DOE/NV/10845–9) **A deuterium-calibrated, discrete-state compartment model of regional groundwater flow, Nevada Test Site and vicinity.** Sadler, W.R. (Nevada Univ., Reno, NV (United States). Water Resources Center); Campana, M.E.; Jacobson, R.L.; Ingraham, N.L. Nevada Univ., Reno, NV (United States). Water Resources Center. Mar 1992. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-90NV10845. Order Number DE92012690. Source: OSTI; NTIS; GPO Dep.

A discrete-state compartment (DSC) model was developed, using the conservative tracer deuterium, to simulate the regional groundwater flow for a portion of southern Nevada, including the Nevada Test Site. The model simulates flow rates, discharge rates, and flow directions, as well as mean ages of the groundwater. The results obtained by this model were found to be similar to those of other studies and available hydrogeologic information. The deep regional groundwater was observed to consistently be more depleted in deuterium than the local vertical recharge waters. However, the deep system is consistently more enriched in deuterium than the underflow water from higher latitudes, which was used as input for the model. The total groundwater flow through the modeled area was estimated to be 58.9×10^6 m^3/yr. Approximately 40 percent of this ground water originates as underflow from the higher latitudes, while the remaining 60 percent is from local vertical recharge. The Spring Mountains and the Fortymile Canyon/Wash–Stockade Wash area were determined to be sources of major vertical recharge with 9.6 x 10^6 m^3/yr, and 7.6 x 10^6 m^3/yr of recharge, respectively. The simulated ages of the groundwater were found to vary considerably, however, the ages do not correlate with position along the simulated flow path. The mean and median ages of the groundwater at Fortymile Canyon/Wash were simulated to be 6,700 and 1,400 years, respectively, while the ages of the groundwater at Yucca Flat were 26,300 and 21,600 years, respectively.

19473 (DOE/PC/90303–T1) **The potential for solubilizing agents to enhance the remediation of hydrophobic organic solutes in soil-water suspensions: [Quarterly report].** Laha, S.; Liu, Z.; Edwards, D.; Luthy, R.G. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Civil Engineering. Feb 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90303. Order Number DE92011416. Source: OSTI; NTIS; GPO Dep.

This paper discusses the feasibility for use of surfactant solubilizing agents to enhance the solubility and the rate of microbial degradation of hydrophobic organic solutes in soil-water suspensions. Hydrophobic organic contaminants are strongly sorbed to soil or sediment material, and as a consequence the rate of microbial degradation may depend greatly on the desorption of the sorbed-phase contaminant and the accessibility of the contaminant to soil microorganisms. Chemical solubilizing agents may enhance the rate of hydrophobic organic solute degradation by increasing the rate of solute desorption from soil and the extent of solute partitioning to the aqueous phase. The presentation will review ongoing research on: surfactant solubilization of polycyclic aromatic hydrocarbon (PAH) compounds in clean water, and in soil-water suspensions; and experiments to assess if the addition of surfactant to soil-water suspension results in faster rate of mineralization of PAH compounds in soil.

19474 (DOE/PC/90303–T2) **Rates of solubilization and biodegradation of PAH compounds in porous media: [Quarterly report].** Luthy, R.G. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Civil Engineering. Nov 1991. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90303. Order Number DE92011417. Source: OSTI; NTIS; GPO Dep.

Microbial degradation of hydrophobic organic compounds in soils and aquifer media is dependent on rates of desorption of these compounds from solids and rates of solubilization from residual nonaqueous phase liquids (NAPLs). The couples processes involving microbial degradation and hydrophobic compound availability are not well understood. The proposed research effort explores certain physicochemical phenomena that may have a significant affect on the rate of microbial degradation of hydrophobic organic compounds in porous media. The investigation will examine rates of biomineralization of polycyclic aromatic hydrocarbon (PAH) compounds that are leached from a residual saturation of coal tar. Batch and continuously-stirred reactor studies will be used to measure solute equilibrium concentrations and rates of solubilization of PAH compounds from coal tar imbided into microporous silica media. These rates will be compared with rates of mineralization of ^{14}C-labeled compounds in similar systems inoculated with a culture of PAH degrading microorganisms. Column experiments will also be conducted to assess the rates of solubilization and mass transfer coefficients from coal tar entrapped in a sandy aquifer material by capillary forces.

19475 (DOE/RL–92-03) **Annual report for RCRA groundwater monitoring projects at Hanford Site facilities for 1991.** Westinghouse Hanford Co., Richland, WA (United States). Geosciences Group. Feb 1992. 350p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012309. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes ground water monitoring activities at the Hanford Reservation. Maps are included of water tables and water chemistry is discussed. (CBS)

19476 (DPST–72-210) **Release of radioactive wash water to ground, Tim's Branch, and seepage basin during cave decontamination.** Waters, D.E. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 26 Jan 1972. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013213. Source: OSTI; NTIS; GPO Dep.

During decontamination work in the High Level Caves, contaminated wash water leaked from a separator pit beneath the High Level Caves wing (E Wing) of Building 773-A. The waste water leaked through two pathways of radioactivity release. (1) An estimated 1000 gallons of waste water entered an auxiliary pipe trench, leaked from this trench into the ground beneath E Wing, and then seeped from the ground into a storm sewer that drains into Tim's Branch, a stream about 500 ft behind the Technical Area. (2) A larger quantity of waste water (~ 2500 gallons) entered a waste line trench from which most of it was pumped to the high level waste system.

19477 (DPST–76-221) **Preliminary I-129 measurements in the SRP environs.** Hochel, R.C. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 23 Jan 1976. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92013220. Source: OSTI; NTIS; GPO Dep.

Recently a preliminary program at Savannah River Plant was began to measure I-129 concentrations in a variety of environmental samples. The objectives of the study were three-fold: First, to at least qualitatively estimate the impact of Savannah River Plant (SRP) operations on the I-129 inventory in the surrounding area; second, to determine prominent pathways of I-129 to man and to obtain, where possible, estimates of their associated dose rates; and third, to provide necessary input data to help in the design and implementation of more comprehensive follow-up studies.

19478 (DPST–87-820) **Summary of I-129 measurements in ground and surface waters.** Kantelo, M.V. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 17 Nov 1987. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE92013190. Source: OSTI; NTIS; GPO Dep.

The iodine-129 content of groundwater and surface water at onplant (Savannah River Plant) and off-plant locations has been determined at irregular intervals since 1970 using neutron activation analysis. I-129 was detected in groundwater near the Burial Ground and near the seepage basins of the Separations areas. For reference, I-129 concentrations in the groundwater can be compared to the EPA drinking water standard. At a few locations the concentrations exceeded both the existing and pending EPA drinking water standard. In surface water, Four Mile Creek was the only SRP stream found to transport significant I-129 to the Savannah River. Dilution by C-Reactor discharge and the Savannah River reduced the off-plant I-129 concentrations in river water to less than 1% of the existing EPA drinking water standard and less than 0.01% of the pending EPA drinking water standard.

19479 (EGG-ESQ–10167) **Monitoring activities review of the Radiological Environmental Surveillance Program.** Ritter, P.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013103. Source: OSTI; NTIS; INIS; GPO Dep.

The 1992 Monitoring Activities Review (MAR) is directed at the Radiological Environment Surveillance Program (RESP) activities at the Radioactive Waste Management Complex (RWMC) of Idaho Engineering Laboratory (INEL). MAR panelists studied RESP documents and discussed their concerns with Environmental Monitoring Unit (EMU) staff and other panel members. These concerns were subsequently consolidated into a collection of recommendations with supporting discussions. Recommendations focus on specific monitoring activities, as well as the overall program. The MAR report also contains pertinent comments that should not require further action.

19480 (EGG-GEO–9987) **Aquifer test at Comore Loma No. 4, Idaho Falls, Idaho.** Hubbell, J.M. EG and G Idaho, Inc., Idaho

Falls, ID (United States). Dec 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92011699. Source: OSTI; NTIS; GPO Dep.

An aquifer test was conducted at Comore Loma Well #4 to determine the aquifer hydraulic characteristics at this location on July 11 and 12, 1991. Water was withdrawn from Comore Loma Well #4 at approximately 850 gallons per minute for 8 hours while monitoring the water level in the plumping well and an observation well 930 ft away. The pumped well showed over 12 ft of drawdown with no discernable drawdown in the observation well. The drawdown in the pumped well was nearly instantaneous, showing little additional drawdown after 1 minute. The transmissivity was calculated to be approximately 140,000 ft^2/day using the Jacob solution. This gives a hydraulic conductivity of 1300 ft/day for the 110 ft interval tested. The high transmissivity and geologic setting suggest the aquifer may in part produce water from the Snake River Plain aquifer. However, the warm water temperature (71°F) indicates the presence of a geothermal source typical of the foothills aquifer. The storage coefficient could not be calculated since no water level decline was detected in the observation well.

19481 (EGG-GEO-9990) **Aquifer tests near the Idaho Falls Foothills, Idaho.** Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). 3 Oct 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012237. Source: OSTI; NTIS; GPO Dep.

Ground water pumping tests were performed in two wells located in the foothills east of Idaho Falls to determine the aquifer characteristics at these locations. These data were used to differentiate this aquifer from the Snake River Plain aquifer. The wells were pumped at rates of 11 and 14 gallons per minute with 0.03 and 0.04 ft of drawdown measured in the pumping wells. The transmissivity is estimated to be 525,000 gpd/ft and 450,000 gpd/ft, respectively. The hydraulic conductivity is 925 ft/day and 1,070 ft/day, respectively. These hydraulic conductivities are similar to those measured in the Snake River Plain aquifer. Water level data in these wells are consistent with the water table in the Snake River Plain aquifer and indicates ground water movement from the foothills toward the Plain. The high transmissivity suggests water may move rapidly from the foothills area to mix with water in the Snake River Plain aquifer. Elevated water temperatures (76 and 70°F) and high specific conductivities in these wells indicate the presence of a foothills aquifer with characteristics that can be used to separate the two aquifer systems.

19482 (EGG-WM-9857) **Analysis of the low-level waste radionuclide inventory for the Radioactive Waste Management Complex performance assessment.** Plansky, L.E.; Hoiland, S.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 226p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012374. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of a study to improve the estimates of the radionuclides in the low-level radioactive waste (LLW) inventory which is buried in the Idaho National Engineering Laboratory (INEL) Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). The work is done to support the RWMC draft performance assessment (PA). Improved radionuclide inventory estimates are provided for the INEL LLW generators. Engineering, environmental assessment or other research areas may find use for the information in this report. It may also serve as a LLW inventory baseline for data quality assurance. The individual INEL LLW generators, their history and their activities are also described in detail.

19483 (EGG-WTD-9980) **Identification of buried structures (aerial surveillance and analysis of buried waste) long-range project plan.** Williams, K.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012216. Source: OSTI; NTIS; INIS; GPO Dep.

This long-range plan presents the plan (i.e., budget, schedule, justification, and plans for technology deployment) for implementation of the Identification of Buried Structures project. Two subcontractors will test and demonstrate their technologies at the Idaho National Engineering Laboratory during October and November 1991, and will analyze their data and submit final reports to EG&G Idaho, Inc., by the end of December 1991. By February 21, 1992, EG&G Idaho will present a final report to the Department of Energy, assessing the subcontractor's results and recommending further action.

19484 (EGG-WTD-10080) **Rapid monitoring of soil, smears, and air dusts by direct large-area alpha spectrometry.** Sill, C.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012528. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental conditions to permit rapid monitoring of soils, smears, and air dusts for transuranic (TRU) radionuclides under field conditions are described. The monitoring technique involves direct measurement of alpha emitters by alpha spectrometry using a large-area detector to identify and quantify the radionuclides present. The direct alpha spectrometry employs a circular gridded ionization chamber 35 cm in diameter which accommodates either a circular sample holder 25 cm in diameter or a rectangular one 20 by 25 cm (8 by 10 in.). Soils or settled dusts are finely ground, suspended in 30% ethanol, and sprayed onto a 25-cm stainless steel dish. Air dusts are collected with a high-volume sampler onto 20- by 25-cm membrane filters. Removable contamination is collected from surfaces onto a 20- by 25-cm filter using an 18-cm (7-in.) paint roller to hold the large filter in contact with the surface during sample collection. All three types of samples are then counted directly in the alpha spectrometer and no other sample preparation is necessary. Some results obtained are described.

19485 (EGG-WTD-10180) **Evaluation of airborne thermal, magnetic, and electromagnetic characterization technologies.** Josten, N.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013101. Source: OSTI; NTIS; INIS; GPO Dep.

The identification of Buried Structures (IBS) or Aerial Surveillance Project was initiated by the US Department of Energy (DOE) Office of Technology Development to demonstrate airborne methods for locating and identifying buried waste and ordnance at the Idaho National Engineering Laboratory (INEL). Two technologies were demonstrated: (a) a thermal infrared imaging system built by Martin Marietta Missile Systems and (b) a magnetic and electromagnetic (EM) geophysical surveying system operated by EBASCO Environmental. The thermal system detects small differences in ground temperature caused by uneven heating and cooling of the ground by the sun. Waste materials on the ground can be detected when the temperature of the waste is different than the background temperature. The geophysical system uses conventional magnetic and EM sensors. These sensors detect disturbances caused by magnetic or conductive waste and naturally occurring magnetic or conductive features of subsurface soils and rock. Both systems are deployed by helicopter. Data were collected at four INEL sites. Tests at the Naval Ordnance Disposal Area (NODA) were made to evaluate capabilities for detecting ordnance on the ground surface. Tests at the Cold Simulated Waste Demonstration Pit were made to evaluate capabilities for detecting buried waste at a controlled site, where the location and depth of buried materials are known. Tests at the Subsurface Disposal Area and Stationary Low-Power Reactor-1 burial area were made to evaluate capabilities for characterizing hazardous waste at sites that are typical of DOE buried waste sites nationwide.

19486 (EMO-1045) **Contingent post-closure plan, hazardous waste management units at selected maintenance facilities, US Army National Training Center, Fort Irwin, California.** Pacific Northwest Lab., Richland, WA (United States). Environmental Management Operations. Jan 1992. 62p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012140. Source: OSTI; NTIS; INIS; GPO Dep.

The National Training Center (NTC) at Fort Irwin, California, is a US Army training installation that provides tactical experience for battalion/task forces and squadrons in a mid- to high-intensity combat scenario. Through joint exercises with US Air Force and other services, the NTC also provides a data source for improvements of training doctrines, organization, and equipment. To meet the training and operational needs of the NTC, several maintenance facilities provide general and direct support for mechanical devices, equipment, and vehicles. Maintenance products used at these facilities include fuels, petroleum-based oils, lubricating grease, various degreasing solvents, antifreeze (ethylene glycol), transmission fluid, brake fluid, and hydraulic oil. Used or spent petroleum-based products generated at the maintenance facilities are temporarily accumulated in underground storage tanks (USTs), collected by the NTC hazardous waste management contractor (HAZCO), and stored at the Petroleum, Oil, and Lubricant (POL) Storage Facility, Building 630, until shipped off site to be recovered, reused, and/or reclaimed. Spent degreasing solvents and other hazardous wastes are containerized and stored on-base for up to 90 days at the NTC's Hazardous Waste Storage Facility, Building 703. The US Environmental Protection Agency (EPA) performed an inspection and reviewed the hazardous waste management operations of the NTC. Inspections indicated that the NTC had violated one or more requirements of Subtitle C of the Resource Conservation and Recovery Act (RCRA) and as a result of these violations was issued a Notice of Noncompliance, Notice of Necessity for Conference, and Proposed Compliance Schedule (NON) dated October 13, 1989. The following post-closure plan is the compliance-based approach for the NTC to respond to the regulatory violations cited in the NON.

19487 (EPA-520/5-91-004) **Radiological surveys of naval facilities in the New London Harbor and on the Thames River, Connecticut.** Semler, M.O. (National Air and Radiation Environmental Lab., Montgomery, AL (United States)); Blanchard, R.L. Environmental Protection Agency, Washington, DC (United States). Office of Radiation Programs. Dec 1991. 44p. Sponsored by Environmental Protection Agency, Washington, DC (United States). Source: OSTI; INIS; US Environmental Protection Agency, Office of Radiation Programs, 401 M. Street, S.W., Washington, DC 20460.

This report presents results of the surveys conducted by NAREL personnel to assess levels of environmental radioactivity resulting from maintenance and operation of nuclear-powered warships at the New London Submarine Base (NLSB). General Dynamics Electric Boat Division, Sound Signature Facility, and the State Pier, all located within New London, Connecticut, Harbor on the Thames River. The purpose of the survey was to determine if activities related to nuclear-powered warships resulted in release of radionuclides which may contribute to significant population exposure of contamination of the environment.

19488 (ESH-EMS-90-0131) **The Savannah River Site's Groundwater Monitoring Program: First quarter, 1990.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). 18 Oct 1990. 628p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92012662. Source: OSTI; NTIS; GPO Dep.

This report summarizes the Savannah River Site (SRS) groundwater monitoring program conducted in the first quarter of 1990. It includes the analytical data, field data, well activity data, and the other documentation for this program and provides a record of the program's activities and rationale and an official document of the analytical results. The groundwater monitoring program includes the following activities: installation, maintenance, and abandonment of monitoring wells, environmental soil borings, development of the sampling and analytical schedule, collection and analyses of groundwater samples, review of the analytical data and other data, maintenance of the databases containing groundwater monitoring data and related data, quality assurance (QA) evaluations of laboratory performance, and reports of results to waste-site facility custodians and to the Environmental Protection Section (EPS) of EPD.

19489 (ESH-EMS-90-0132) **The Savannah River Site's Groundwater Monitoring Program, second quarter 1990.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). 7 Feb 1991. 595p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013124. Source: OSTI; NTIS; GPO Dep.

The Environmental Protection Department/Environmental Monitoring Section (EPD/EMS) administers the Savannah River Site's (SRS) Groundwater Monitoring Program. During second quarter 1990 (April through June) EPD/EMS conducted routine sampling of monitoring wells and drinking water locations. EPD/EMS established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRS groundwater, and drinking water standards. An explanation of flagging criteria for the second quarter is presented in the Flagging Criteria section of this document. All analytical results from second quarter 1990 are listed in this report.

19490 (ESH-EMS-890043) **The Savannah River Site's Groundwater Monitoring Program, first quarter 1989.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). [1989]. 481p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013085. Source: OSTI; NTIS; GPO Dep.

The Environmental Monitoring Section of the Environmental and Health Protection (EHP) Department administers the Savannah River Site's Groundwater Monitoring Program. During first quarter 1989 (January–March), EHP conducted routine sampling of monitoring wells and drinking water locations. EHP collected the drinking water samples from Savannah River Site (SRS) drinking water systems supplied by wells. EHP established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRS groundwater, and drinking water standards. An explanation of flagging criteria for the first quarter is presented in the Flagging Criteria section of this document. All analytical results from first quarter 1989 are listed in this report, which is distributed to all waste-site custodians.

19491 (ESH-EMS-890044) **The Savannah River Site's Groundwater Monitoring Program, second quarter 1989.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). [1989]. 455p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013084. Source: OSTI; NTIS; GPO Dep.

The Environmental Monitoring Section of the Environmental and Health Protection (EHP) Department administers the Savannah River Site's Groundwater Monitoring Program. During second quarter 1989 (April–June), EHP conducted routine sampling of monitoring wells and drinking water locations. EHP collected the drinking water samples from Savannah River Site (SRS) drinking water systems supplied by wells. EHP established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRS groundwater, and drinking water standards. An explanation of flagging criteria for the second quarter is presented in the Flagging Criteria section of this document. All analytical results from second quarter 1989 are listed in this report, which is distributed to all waste-site custodians.

19492 (ESH-EMS-890045) **The Savannah River Site's Groundwater Monitoring Program, third quarter 1989.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). [1989]. 479p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013082. Source: OSTI; NTIS; GPO Dep.

The Environmental Monitoring Section of the Environmental and Health Protection (EHP) Department administers the Savannah River Site's Groundwater Monitoring Program. During third quarter 1989 (July–September), EHP conducted routine sampling of monitoring wells and drinking water locations. EHP collected the drinking water samples from Savannah River Site (SRS) drinking water systems supplied by wells. EHP established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels; instead they aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRS groundwater, and drinking water standards. An explanation of flagging criteria for the third quarter is presented in the Flagging Criteria section of this document. All analytical results from third quarter 1989 are listed in this report, which is distributed to all waste-site custodians.

19493 (ESH-EMS–890046) **The Savannah River Site's Groundwater Monitoring Program: Fourth quarter, 1989.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). [1989]. 472p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013267. Source: OSTI; NTIS; GPO Dep.

The Environmental Monitoring Section of the Environmental and Health Protection (EHP) Department administers the Savannah River Site's Groundwater Monitoring Program. During fourth quarter 1989 (October–December), EHP conducted routine sampling of monitoring wells and drinking water locations. EHP collected the drinking water samples from Savannah River Site (SRS) drinking water systems supplied by wells. EHP established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria aid personnel in sample scheduling, interpretation of data, and trend identification. An explanation of flagging criteria for the fourth quarter is presented in the Flagging Criteria section of this document. All analytical results from fourth quarter 1989 are listed in this report, which is distributed to all waste-site custodians.

19494 (ESH-EMS–900133) **The Savannah River Site's groundwater monitoring program: Third quarter 1990.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). 6 May 1991. 728p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92012661. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Protection Department/Environmental Monitoring Section (EPD/EMS) administers the Savannah River Site's (SRS) Groundwater Monitoring Program. During third quarter 1990 (July through September) EPD/EMS conducted routine sampling of monitoring wells and drinking water locations. EPD/EMS established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels; instead they aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRS groundwater, and drinking water standards. All analytical results from third quarter 1990 are listed in this report, which is distributed to all site custodians. One or more analytes exceeded Flag 2 in 87 monitoring well series. Analytes exceeded Flat 2 for the first since 1984 in 14 monitoring well series. In addition to groundwater monitoring, EPD/EMS collected drinking water samples from SRS drinking water systems supplied by wells. The drinking water samples were analyzed for radioactive constituents.

19495 (ESH-EMS–900134) **The Savannah River Site's Groundwater Monitoring Program: Fourth quarter, 1990.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). 18 Jun 1991. 567p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011908. Source: OSTI; NTIS; GPO Dep.

This report summarizes the Savannah River Site (SRS) groundwater monitoring program conducted in the fourth quarter of 1990. It includes the analytical data, field data, well activity data, and other documentation for this program, provides a record of the program's activities and rationale, and serves as an official document of the analytical results. The groundwater monitoring program includes the following activities: installation, maintenance, and abandonment of monitoring wells, environmental soil borings, development of the sampling and analytical schedule, collection and analyses of groundwater samples, review of analytical and other data, maintenance of the databases containing groundwater monitoring data, quality assurance (QA) evaluations of laboratory performance, and reports of results to waste-site facility custodians and to the Environmental Protection Section (EPS) of EPD.

19496 (ESH-EMS–910088) **The Savannah River Site's Groundwater Monitoring Program: Second quarter, 1991.** Westinghouse Savannah River Co., Aiken, SC (United States); Exploration Resources, Inc., Athens, GA (United States). 10 Jan 1992. 568p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013263. Source: OSTI; NTIS; GPO Dep.

The Environmental Protection Department/Environmental Monitoring Section (EPD/EMS) administers the Savannah River Site's (SRS) Groundwater Monitoring Program. During second quarter 1991 EPD/EMS conducted extensive sampling of monitoring wells. EPD/EMS established two sets of flagging criteria in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels; instead, they aid personnel in sample scheduling, interpretation of data, and trend identification. Beginning in 1991, the flagging criteria are based on EPA drinking water standards and method detection limits. A detailed explanation of the current flagging criteria is presented in the Flagging Criteria section of this document. Analytical results from second quarter 1991 are listed in this report.

19497 (EUR–12503(v.1)) **Development of modelling and forecasting in geology. (Volume 1): Evaluation of weathering and erosion velocity in different media.** Afzali, H. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Fourniguet, J.; Peaudecerf, P. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 49p. (In French). Contract FI1W/0048-F. Source: OSTI; NTIS (US Sales Only).

To assess the long-term safety of radioactive waste disposal systems, validation of predictive models is essential and large efforts should be given to barriers, particularly geologic barriers. This work appears in the form of four volumes, the subject of the first part is described below. Soils and rocks erosion depends upon climate, relief, lithology and human activities (deforesting). In the world, mechanical erosion is evaluated from 5 to 8 cm per 1000 years (mean denudation ratio). Rocks weathering solubilize chemical elements in the running water and rocks fracturation becomes more easily under erosion effects. Alteration front progress is 0.3-3 cm per 1000 years in temperate zones and 4-7 cm per 1000 years in tropical zones. 5 figs., 14 tabs., 80 refs.

19498 (EUR–12503(v.2)) **Development of modelling and forecasting in geology. (Volume 2): Herode model: weathering and erosion computerized simulation.** Seguin, J.J. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Fourniguet, J.; Peaudecerf, P. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 100p. (In French). Contract FI1W/0048-F. Source: OSTI; NTIS (US Sales Only).

To access the long-term safety of radioactive waste disposal systems, validation of predictive models is essential and large efforts should be given to barriers, particularly geologic barriers. This work appears in the form of four volumes, the subject of the second part is described below. HERODE (calculation of relief altitude under erosion process from 0 to 100000 years) is a weathering and erosion computerized simulation. The model describes materials and rocks transport and also substratum weathering process. FORTRAN 77 is the software language. 31 figs., 6 tabs., 40 refs.

19499 (EUR–12503(v.3)) **Development of modelling and forecasting in geology (Volume 3): Glaciation influence simulation on rocks deformations and run-off in sedimentary serie.** Modaressi, H. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Gentier, S; Fourniguet, J.; Peaudecerf, P. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 89p. (In French). Contract FI1W/0048-F. Source: OSTI; NTIS (US Sales Only).

To access the long-term safety of radioactive waste disposal systems, validation of predictive models is essential and large efforts should be given to barriers, particularly geologic barriers. This work appears in the form of four volumes, the subject of the third part is described below. This work shows the compacting effects on a sedimentary serie and the consequences on fluid flows in water-table with an ice-cape progressive arrival. The fast advance of the glacier prevents from the entire sedimentary beds consolidation and it appears a horizontal fluid flow along the progression axis. The computerized simulation uses GEFDYN code, a finite elements code. 27 figs., 12 refs.

19500 (GEO-EIS–86) **Characterization of groundwater flow and transport in the General Separations Areas, Savannah River Plant: Flow model refinement and particle-tracking analysis report.** Duffield, G.M. (GeoTrans, Inc., Sterling, VA (United States)); Buss, D.R.; Root, R.W. Jr.; Hughes, S.S.; Mercer, J.W. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab.; GeoTrans, Inc., Sterling, VA (United States). Mar 1986. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013128. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) is preparing the necessary NEPA documentation for an Environmental Impact Statement (EIS) to address the waste disposal activities for groundwater protection at the Savannah River Plant (SRP). For purposes of this EIA, the areas within the plant have been separated into 26 functional groups based primarily on hydrogeologic setting and types of disposed waste materials. The overall objective is to provide an appropriate quantitative assessment of the environmental impacts from past and future operations within each functional group. The analysis from each functional group will be integrated to assess the impacts of plant-wide operations. A flexible approach to quantifying the impacts using several methods of quantitative analysis is being employed. Numerical flow and transport modeling is one method being applied to several functional groups. The scope of work can be divided into four broad categories: (1) Data Review and Conceptual Model Development, (2) Groundwater Flow Model Construction and Refinement, (3) Solute Transport Model Construction, and (4) Remedial Alternative Simulations. The major topics covered in this report are: (1) summary of the hydrogeologic conditions of the area, (2) observed flow velocities at the study site, (3) a summary of results from the preliminary flow modeling effort, (4) flow model refinement and results, and (5) particle tracking analyses based on the refined flow model.

19501 (GSF-HY–1/91) **Annual report 1990 of the GSF Institute of Hydrology.** GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. 182p. (In German). Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The main areas of activities in the period under review are the material cycles, the geochemistry of heavy metals and of radionuclides, and the transport of substances in the aquatic environment and the atmospheric environment, with particular emphasis on the ground water and the substances dissolved therein. Site-specific hydro-geological studies and studies into the isotope hydrology, also at the sites of repositories, are presented. Within the framework of investigations of the poleo-climate, the Institute carried out studies on the isotope stratigraphy in the Antarctica. Novel developments in tracer techniques are reported. (DG).

19502 (GSF-HY–1/91, pp. 91-100) **Study into the underground production of the isotopes ^{39}Ar, ^{4}He, ^{222}Rn in aquifers of selected mineral waters.** Forster, M.; Weise, S.; Ramm, K.; Baumann, M. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The underground production of the environmental isotopes in ground-water aquifers of the spa Bad Steben, at Kondrau, Windisch-Eschenbach, and Mitterteich have been performed for detecting Ar-39 in particular. The contents of He-3/He-4, Rn-222 and Ra-226 of these ground waters have been used as parameters indicating underground isotope production, together with the U and Th concentrations in the aquifer water samples. The H-3, C-14 and Kr-85 concentrations have been used to infer the mean residence times of the ground waters. (DG).

19503 (GSF-HY–1/91, pp. 115-119) **Radiohydrometric investigations.** Drost, W.; Hofreiter, G.; Reichlmayr, E.; Weindl, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

The investigations were to determine the parameters of the ground-water flow and the aquifer, pridominantly in loose rock. The paper reports in particular on measurements intended to solve problems encountered in connection with work for road and building construction and hydraulic works at the site of the planned research reactor II in Garching/Bavaria, for a tunnel near Starnberg, and for the dams planned at Sylvenstein, Lac Salaufe, Brombach, and Kleine Roth. (DG).

19504 (GSF-HY–1/91, pp. 136-140) **Design of an equipment for measuring Krypton-85 in water for age determination of young ground waters.** Held, J.; Schuhbeck, S.; Rauert, W. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

Krypton-85 dissolved in water can be used as an indicator for determination of age and classification of young ground waters with mean residential periods of up to several decades. With the method and equipment reported in the paper, the Kr-85 is extracted from the water and is measured in a flow-through methane counter. (DG).

19505 (GSF-HY–1/91, pp. 150-153) **Synthesis of propane via hydrogenation of propadiene, propyne or propene, for low-level measurement of tritium.** Wolf, M.; Singer, C. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Hydrologie. Oct 1991. (In German). In *Annual report 1990 of the GSF Institute of Hydrology.* 182p. Order Number DE92511426. Source: OSTI; NTIS (US Sales Only); INIS.

Very small tritium accumulations in ground water can be measured by means of scanning propane, prepared by partial, electrolytic enrichment with tritium, in a gas proportional counter. It is shown that for most applications propyne or propene can be used for counting gas preparation instead of propadiene, as the detection limits achieved with them are 0.095 or 0.12 TU, respectively. (DG).

19506 (HAN–17226) **Cooperation with US Geological Survey.** Hanford Works, Richland, WA (United States). 6 Aug 1948. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011857. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a reference made to a memorandum about the cooperation between the Hanford Site and the US Geological Survey. The US Geological Survey was at the site to work with Hanford on geological problems the site was having. They worked together to locate the water supply wells of the site which would be coordinated with the drilling program. They also worked together on the possible contamination to the 300 and 3000 area wells. (MB)

19507 (HPR–87-002) **The Savannah River Plant's Waste-Site Groundwater Monitoring Program: Third quarter 1986.** Heath, E.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)); Taus, L.B.; Olson, C.M. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1986]. 183p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013081. Source: OSTI; NTIS; GPO Dep.

The Savannah River Plant Groundwater Monitoring Program is administered by the Environmental Monitoring Group of the Health Protection Department. There are 331 active groundwater wells at 61 monitoring sites that are sampled and analyzed. Each sample may be analyzed for up to 41 parameters depending on the site history and location. Two sets of flagging criteria were established during the first quarter of 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels, but are intended to aid personnel in sample scheduling, interpretation of data, and trend identification. The first-level flagging criteria are based on detection limits or background levels in SPR groundwater. The second-level flagging criteria are based on standards for each parameter. All analytical results from the third quarter (July–September) of 1986 are listed in this report, which will be distributed to all waste-site custodians.

19508 (HPR–87-158) **The Savannah River Plant's Groundwater Monitoring Program: First quarter 1987.** Heath, E.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)); Taus, L.B.; Olson, C.M. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1987]. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013077. Source: OSTI; NTIS; INIS; GPO Dep.

The Savannah River Plant's Groundwater Monitoring Program is administered by the Environmental Monitoring Group of the Health Protection Department. During the first quarter of 1987 (January–March) comprehensive monitoring including tritium analyses was performed on the waste-site monitoring wells. Radioactive monitoring wells were monitored routinely. All analytical results from the first quarter of 1987 are listed in this report, which will be distributed to all waste-site custodians. There were 61 monitoring sites in which one or more parameters exceeded the second-level flagging criteria. There were 23 monitoring sites that had parameters exceeding the second-level flagging criteria for the first time since 1984. Those sites with constituents above the second-level flagging criteria in the first quarter of 1987 are listed in the following table and organized by location.

19509 (HPR–88-098) **The Savannah River Plant's Groundwater Monitoring Program, fourth quarter 1987.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1987]. 224p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013086. Source: OSTI; NTIS; GPO Dep.

The Savannah River Plant's Groundwater Monitoring Program is administered by the Environmental Monitoring Group of the Health Protection Department. During the fourth quarter of 1987 (October–December), routine monitoring was performed on monitoring wells and drinking water locations. This quarterly report includes the radioactive monitoring data from drinking water. These data were collected from SRP drinking water systems supplied by wells. Two sets of flagging criteria were established in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels but are intended to aid personnel in sample scheduling, interpretation of data, and trend identification. The first-level flagging criteria are based on detection limits or background levels in SRP groundwater. The second-level flagging criteria are based on various water standards or levels significantly above background. During the fourth quarter of 1987, Priority Pollutant analyses were conducted on LFW wells and Appendix IX analyses were conducted on FSB point-of-compliance wells. Also during this quarter, one drinking water sample exceeded the first-level flagging criteria.

19510 (HPR–88-238) **The Savannah River Plant's Groundwater Monitoring Program: First quarter, 1988.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1988]. 312p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013389. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the groundwater monitoring program conducted by the Environmental Monitoring Group of the Health Protection Department in the first quarter of 1988 and includes the analytical results, field data, and detailed documentation for this program. The purpose of this report is two-fold. First, the report provides a historical record of the activities and the rationale of the program; second, it provides an official document of the analytical results.

19511 (HPR–88-300) **The Savannah River Plant's Groundwater Monitoring Program, second quarter 1988.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1988]. 316p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92013388. Source: OSTI; NTIS; GPO Dep.

The Savannah River Plant's Groundwater Monitoring Program is administered by the Environmental Monitoring Group of the Health Protection Department. During the second quarter of 1988 (April–June), routine monitoring was performed on monitoring wells and drinking water locations. This quarterly report includes the radioactive monitoring data from drinking water. These data were collected from Savannah River Plant (SRP) drinking water systems supplied by wells. Two sets of flagging criteria were established in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels but are intended to aid personnel in sample scheduling, interpretation of data, and trend identification. The first-level flagging criteria are based on detection limits or background levels in SRP groundwater. The second-level flagging criteria are based on various water standards or levels considerably above background. One drinking water sample exceeded the first-level flagging criteria during this quarter.

19512 (HPR–88-489) **The Savannah River Plant's Groundwater Monitoring Program, third quarter 1988.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant; Exploration Software, Athens, GA (United States). [1988]. 294p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013141. Source: OSTI; NTIS; GPO Dep.

The Environmental Monitoring Group of the Health Protection Department administers the Savannah River Plant's Groundwater Monitoring Program. During third quarter 1988 (July–September), routine sampling of monitoring wells and drinking water locations was performed. The drinking water samples were collected from Savannah River Plant (SRP) drinking water systems supplied by wells. Two sets of flagging criteria were established in 1986 to assist in the management of sample results. The flagging criteria do not define contamination levels but are intended to aid personnel in sample scheduling, interpretation of data, and trend identification. The flagging criteria are based on detection limits, background levels in SRP groundwater, and drinking water standards. An explanation of flagging criteria for the third quarter is presented in the Flagging Criteria section of this document. All analytical results from third quarter 1988 are listed in this report, which is distributed to all waste-site custodians.

19513 (INIS-GB–433) **Annual report on radioactive discharges and monitoring of the environment 1990. V. 1: Report on discharges and environmental monitoring.** British Nuclear Fuels plc, Risley (United Kingdom). Health and Safety Directorate. 1991 88p. Order Number DE92627847. Source: OSTI; NTIS (US Sales Only); INIS.

This Annual Report supplements the Health and Safety Annual Report of British Nuclear Fuels plc by providing more detailed information on radioactive discharges, monitoring of the environment and critical group doses. This report has been sub-divided into two complementary parts. Volume I includes annual data for each of the Company sites on radioactive discharges into the environment and the associated environmental monitoring programmes. The sites involved are: Sellafield where the main activities are irradiated nuclear fuel reprocessing and the Calder Hall nuclear station; the Drigg radioactive waste storage and disposal site; the Chapelcross nuclear power station; Springfields Works which manufactures nuclear fuels; Capenhurst Works where uranium isotopic enrichment plants are operated. Volume II reproduces the Certificates of Authorisation under which the Company operates and the statutory environmental monitoring programmes which relate to them. (author).

19514 (ITPR–91018) **Activity concentrations of iodine-131 and radiocesium in milk.** Rabitsch, H.; Kahr, G.; Oswald, K. Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik. Dec 1991. 38p. (In German). Order Number DE92626180. Source: OSTI; NTIS (US Sales Only); INIS.

We have measured the activity concentrations of iodine-131 and radiocesium in pasteurized fresh milk following the Chernobyl accident. Average monthly concentrations of radiocesium are given until December 1991. Samples originated from the local dairy (Milchhof

Graz, Austria) and the measured activities in milk represent a large part of the total intake in the population of Graz. Observed activities are also compared with the activity levels obtained after the earlier nuclear contaminations. From the data of our measurements for radiocesium we have estimated the internal effective dose equivalent due to the intake of contaminated milk during the first year after the fallout. Results indicate that the averaged consumer rates for milk, usually used for predictions of dose, were too high. We have also observed great differences in the activity levels of raw milk and the activities in milk consumed by the population. (authors).

19515 (IVL-B–1044) **Liming and fertilization of forest soils in Germany and Sweden.** Westling, O. Swedish Environmental Research Inst., Lammhult (Sweden). IVL-Aneboda. Nov 1991. 15p. (In Swedish). Order Number DE92506564. Source: OSTI; NTIS (US Sales Only).

This report summarizes background and experiences from forest soil treatments in southern Germany, where large areas have been treated with limestone and fertilized with phosphorus and potassium. Comparisons is made with air pollution exposed forest areas in southern Sweden, and the need for remedial actions is discussed from different viewpoints regarding soil treatments: * To prevent further soil acidification, * Soil restoration regarding base cations and other nutrients, * Remedy existing or expected nutrient shortages in forest stands, and * Compensate for biomass harvesting. 18 refs.

19516 (JAERI-M–91-210) **Diminution of terrestrial gamma ray exposure rate due to snow cover: Ground survey and aerial survey.** Nagaoka, Toshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sakamoto, Ryuichi; Saito, Kimiaki; Tsutsumi, Masahiro; Moriuchi, Shigeru. Japan Atomic Energy Research Inst., Tokyo (Japan). Dec 1991. 27p. (In Japanese). Order Number DE92514960. Source: OSTI; NTIS (US Sales Only); INIS.

In order to clarify the diminution characteristics of terrestrial gamma ray exposure rate due to snow cover, measurements were performed on the ground with and without snow cover. Aerial measurement was also performed above the snow cover in order to obtain information about collective dose evaluation by means of wide and quick environmental survey. The diminution factors observed were 0.36 - 0.17 for the region of 12 - 23 g/cm^2 of water equivalent of the snow cover. According to a calculation by Monte Carlo method, the diminution factors for the same water equivalent range were 0.32 - 0.16. They agreed well as a whole, while the fluctuation of the factors measured were fairly large. The fluctuation is deemed to be due to the inhomogeneity in the distribution of the snow cover and the gamma ray field. The exposure rates on the ground with and without the snow cover were estimated using the aerial survey data with ARSAS (Aerial Radiological Survey and Assessment System). They agreed fairly well with that measured on the ground, while the range of the estimation was several 10%. The estimation range is expected to decrease with increasing the homogeneity of the distribution of the water equivalent and the gamma ray field. (author).

19517 (Juel–2546) **Investigations of soil-plant transfer of radiocesium after deposition from the Chernobyl reactor accident.** Bilo, M. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Radioagronomie; Tuebingen Univ. (Germany). Nov 1991. 129p. (In German). Order Number DE92516927. Source: OSTI; NTIS (US Sales Only); INIS.

Due to the low deposition of radiocaesium in NRW after the Chernobyl accident of about 2500 Bq ^{137}Cs/m^2 and 720 Bq ^{134}Cs/m^2, radiocaesium was not detectable in cereals from NRW. A deposition of about 44,100 Bq ^{137}Cs/m^2 and 13,500 Bq ^{134}Cs/m^2 was calculated for the vicinity of Tannheim, a village in Upper Swabia. Nevertheless, the content of radiocaesium in grain from Upper Swabia was found to be more than one hundred times lower than that of natural ^{40}K. Transferfactors (TF/SP) for radiocaesium were determined for cereals from the three investigated soil types: Kalkvega (FAO classification: Calcaric Fluvisol), Braunerde (Cambisol) and Parabraunerde-Pseudogley (Luvisol-Planosol). The total variation in TF(SP) from 54 sampling sites was a factor of 43 (grain) and 18 (straw). However, the values did not reach the calculation basis of the German Regulatory Guide of 0.05 (Allgemeine Berechnungsgrundlage). The maximum TF(SP) for $^{134/137}$Cs in grain of 0.026 is clearly below that limit. A drastic increase of radioactivity in sewage sludge was observed in Upper Swabia. In the Tannheim sewage plant a radiocaesium content of about 12,500 Bq/kg dry matter was measured. In order to obtain further information on the possible radioecological consequences of using this sewage sludge as fertilizer a lysimeter study was carried out with application of the contaminated sewage sludge. Radioactivity in soil and several crops was measured for the growing periods 1989 and 1990. Although the soil type ('worst-case model') could have led one to expect high TF(SP) the increase of radiocaesium in plants was quite small. A higher uptake of radiocaesium by plants is caused by varying the potassium contents of the soil rather than by the application of the contaminated sewage sludge. (orig./HP).

19518 (K/GDP/SAR–15) **Review of earthquake hazard assessments of plant sites at Paducah, Kentucky, and Portsmouth, Ohio.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); Geological Survey, Reston, VA (United States). Mar 1992. 254p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90OR21929 ;AC05-76OR00001. Order Number DE92012314. Source: OSTI; NTIS; INIS; GPO Dep.

Members of the US Geological Survey staff in Golden, Colorado, have reviewed the submissions of Lawrence Livermore National Laboratory (LLNL) staff and of Risk Engineering, Inc. (REI) (Golden, Colorado) for seismic hazard estimates for Department of Energy facilities at Portsmouth, Ohio, and Paducah, Kentucky. We reviewed the historical seismicity and seismotectonics near the two sites, and general features of the LLNL and EPRI/SOG methodologies used by LLNL and Risk Engineering respectively, and also the separate Risk Engineering methodology used at Paducah. We discussed generic issues that affect the modeling of both sites, and performed alternative calculations to determine sensitivities of seismic hazard results to various assumptions and models in an attempt to assign reasonable bounding values of the hazard. In our studies we find that peak acceleration values of 0.08 g for Portsmouth and 0.32 g for Paducah represent central values of the ground motions obtained at 1000-year return periods. Peak accelerations obtained in the LLNL and Risk Engineering studies have medians near these values (results obtained using the EPRI/SOG methodology appear low at both sites), and we believe that these medians are appropriate values for use in the evaluation of systems, structures, and components for seismic structural integrity and for the seismic design of new and improved systems, structures, and components at Portsmouth and Paducah.

19519 (LA–12301-MS) **Colloid research for the Nevada Test Site.** Bryant, E.A. Los Alamos National Lab., NM (United States). May 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011870. Source: OSTI; NTIS; INIS; GPO Dep.

Research is needed to understand the role of particulates in the migration of radionuclides away from the sites of nuclear tests at the Nevada Test Site. The process of testing itself may produce a reservoir of particles to serve as vectors for the transport of long-lived radionuclides in groundwater. Exploratory experiments indicate the presence of numerous particulates in the vicinity of the Cambric test but a much lower loading in a nearby well that has been pumped continuously for 15 years. Recent groundwater colloid research is briefly reviewed to identify sampling and characterization methods that may be applicable at the Nevada Test Site.

19520 (LA-UR–92-708) **Remote sensing applications of the extended radiosity method.** Gerstl, S.A.W.; Borel, C.C. Los Alamos National Lab., NM (United States). [1992]. 3p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205136–2: 1992 international geoscience and remote sensing symposium, Houston, TX (United States), 26-29 May 1992). Order Number DE92011356. Source: OSTI; NTIS; GPO Dep.

In this paper we describe the progress made in the last three years on developing the radiosity method for remote sensing applications. The research covered canopy modeling, volumetric scattering and atmospheric corrections for future analysis of EOS imaging spectrometer data.

19521 (LA-UR–92-709) **Atmospheric corrections of land imagery using the extended radiosity method.** Borel, C.C.; Gerstl, S.A.W. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205136–3: 1992 international geoscience and remote sensing symposium, Houston, TX (United States), 26-29 May 1992). Order Number DE92011355. Source: OSTI; NTIS; GPO Dep.

In this paper we describe an application of the extended radiosity method to compute atmospheric scattering effects over heterogeneous surfaces and to perform the inverse operation: to correct for such atmospheric effects. The radiosity method is used to compute point-spread-functions. (PSF's) which determine how much light is scattered from an adjacent surface into the field-of-view (FOV) of a sensor above the atmosphere. We show that the PSF's are in general asymmetric for pointable airborne or satellite sensors. A Fourier transform based method can be used to correct adjacency-effect-blurred images for these atmospheric distortions.

19522 (LA-UR–92-924) **Lattice gas automata for flow and transport in geochemical systems.** Janecky, D.R.; Chen, S.; Dawson, S.; Eggert, K.C.; Travis, B.J. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920761–11: 7. water-rock interaction conference, Park City, UT (United States), 9-23 Jul 1992). Order Number DE92011236. Source: OSTI; NTIS; GPO Dep.

Lattice gas automata models are described, which couple solute transport with chemical reactions at mineral surfaces within pore networks. Diffusion in a box calculations are illustrated, which compare directly with Fickian diffusion. Chemical reactions at solid surfaces, including precipitation/dissolution, sorption, and catalytic reaction, can be examined with the model because hydrodynamic transport, solute diffusion and mineral surface processes are all treated explicitly. The simplicity and flexibility of the approach provides the ability to study the interrelationship between fluid flow and chemical reactions in porous materials, at a level of complexity that has not previously been computationally possible.

19523 (LA-UR–92-971) **Computerized tomographic analysis of fluid flow in fractured tuff.** Felice, C.W. (Terra Tek, Inc., Salt Lake City, UT (United States)); Sharer, J.C.; Springer, E.P. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205106–2: 9. engineering mechanics conference of American Society of Civil Engineers (ASCE), College Station, TX (United States), 24-27 May 1992). Order Number DE92011232. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this summary is to demonstrate the usefulness of X-ray computerized tomography to observe fluid flow down a fracture and rock matrix imbibition in a sample of Bandelier tuff. This was accomplished by using a tuff sample 152.4 mm long and 50.8 mm in diameter. A longitudinal fracture was created by cutting the core with a wire saw. The fractured piece was then coupled to its adjacent section to that the fracture was not expected. Water was injected into a dry sample at five flow rates and CT scanning performed at set intervals during the flow. Cross sectional images and longitudinal reconstructions were built and saturation profiles calculated for the sample at each time interval at each flow rate. The results showed that for the test conditions, the fracture was not a primary pathway of fluid flow down the sample. At a slow fluid injection rate into the dry sample, the fluid was imbibed into the rock uniformly down the length of the core. With increasing injection rates, the flow remained uniform over the core cross section through complete saturation.

19524 (LA-UR–92-985) **Adjacency-blurring-effect of scenes modeled by the radiosity method.** Borel, C.C.; Gerstl, S.A.W. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920471–4: International Society for Photo Optical Engineering (SPIE) conference, Orlando, FL (United States), 20-24 Apr 1992). Order Number DE92011496. Source: OSTI; NTIS; GPO Dep.

In this paper we describe a method to simulate images through a scattering atmosphere. We compute the scattering of light from adjacent surfaces into the field-of-view (FOV) with the extended radiosity method. Our simulation takes aerosol scattering phase functions and ground bidirectional reflectance distributions (BRDF) into account. 10 refs.

19525 (LA-UR–92-1004) **Speciation of uranium(VI) sorption complexes on montmorillonite.** Chisholm-Brause, C.J. (Los Alamos National Lab., NM (United States)); Morris, D.E.; Richard, R.E. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920761–10: 7. water-rock interaction conference, Park City, UT (United States), 9-23 Jul 1992). Order Number DE92011227. Source: OSTI; NTIS; GPO Dep.

Environmental contaminant releases that contain uranium are among the most serious problems that must be confronted by restoration programs. To facilitate restoration, information concerning the speciation of uranium is needed. Under oxidizing conditions, dissolved uranium is predominantly in the U(VI) (uranyl) form and is quite mobile in the environment, however sorption onto soils may retard its movement. In this study, we have investigated the effects of changes in solution speciation on the nature of uranyl sorption complexes on montmorillonite, a common soil constituent. Aqueous U(VI) solutions between pH 3 to 7 were batch-equilibrated with montmorillonite for several days; specific pH values were selected such that the solutions consisted of dominantly monomeric, oligomeric, or a mix of monomeric and oligomeric aqueous uranyl species. Emission spectroscopy was used to investigate the nature of U(VI) sorbed to montmorillonite.

19526 (NEI-DK–803) **External radiation doses from deposed fly ash with a content of ^{40}K, ^{226}Ra and ^{232}Th.** Hedemann Jensen, P. Risoe National Lab., Roskilde (Denmark). Health Physics Dept. Dec 1991 25p. (In Danish). Order Number DE92627849. Source: OSTI; NTIS (US Sales Only); INIS.

Fly ash from coal fired power plants might be used as filling material below buildings used for habitation. The fly ash content of the radionuclides of potassium, thorium and radium can cause external exposure of the inhabitants to γ radiation emitted during the radioactive decay of those radionuclides. Methods for calculation of the γ dose rate in air at indoor and outdoor positions are described. The dependence of the air dose rate on the vertical and horizontal dimensions of the fly ash material and on the thickness of a covering layer of soil or sand is analysed. The effective annual dose to inhabitants are calculated for typical Danish housing conditions with the buildings placed on a layer of fly ash of infinite vertical and horizontal dimensions and covered by soil or sand of varying thickness. (au) 10 refs.

19527 (NEI-NO–218) **Use of the Birkenes model to study the effects of stream and soil acidification.** Stone, A. Oslo Univ. (Norway). Inst. for Kjemi. 1990 219p. Order Number DE92506563. Source: OSTI; NTIS (US Sales Only).

Mathematical simulation models have long provided scientists with a useful tool for studying the complexities of natural systems, and streamwater acidification models are no exception. The Birkenes model (BIM) has been used in this research to investigate hydrological pathways through the use of long data sets covering a wide range of hydrological conditions and of information provided by conservative tracers such as ^{18}O and Cl^-. Addition of an automatic multi-signal calibration routine has enhanced this process and provided a mathematical tool which provides information on a model structure and parameter identifiability. Few simulation models have undergone so stringent an evaluation process as has the BIM. This indepth evaluation is necessary as it helps to test if the current model structure is capable of approximating natural processes. Without this evaluation, model results are open to considerable inaccuracies and errors. The results indicate that the BIM, although a gross simplification of natural processes, provides a reasonable estimate of streamwater concentrations from data inputs. Several weaknesses were identified particularly in submodels dealing with such species as SO_4 = and Al^{3+}. However, given its simplicity, the BIM can provide simulations for a wide range of chemical species. In addition, the model has been evaluated using data from a catchment which is very chemically and physically different from Birkenes, providing information on the transferability of the model and the quality of the approximations of the inherent chemical processes. The simulations were effected with a modicum of success suggesting that the current model structure can provide useful information about and approximations of chemical processes under a variety of conditions.

19528 (OEFZS–4614) **Modelling of radionuclide transfer to man and the radioecological model OECOSYS.** Gerzabek, M.H. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Jan 1992. 14p. (In German). Order Number DE92625796. Source: OSTI; NTIS (US Sales Only); INIS.

Several processes of radionuclide transport in agro-ecological systems and possible quantitative models are outlined. In particular are treated: dry and wet deposition, uptake into plants via leaves and roots, transfer plant-animal and influence of food processing on the nuclide content of foodstuff. Data from literature and data obtained from the radio-ecological model OECOSYS are used. Finally some examples of model calculations based on the Chernobyl scenario in Austria are presented. The results are compared to measurements performed in 1986 and 1987. (author, translated by Quittner).

19529 (ORNL-MIT–124) **Evaluation of porous carbon and ceramic supports for hyperfiltration.** Cabellon, J.B.; Padia, A.K.; Whitesides, L.E. Jr. Massachusetts Inst. of Tech., Oak Ridge, TN (United States). School of Chemical Engineering Practice-Oak Ridge Station. 24 Mar 1971. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92013030. Source: OSTI; NTIS; GPO Dep.

Porous carbon and ceramic tubes were evaluated as supports for dynamically formed zirconium (IV) hydrous oxide-polycarboxylic acid hyperfiltration membranes. The most promising membranes were formed on Union Carbide 6-C carbon tubes using a 150,000 molecular weight polyacrylic acid. Sodium chloride rejections as high as 97% were obtained at water fluxes of 80 gpd/ft^2 compared with rejections of 90 to 95% and fluxes of 130 gpd/ft^2 using the porous stainless steel-Acropor/Millipore supports. The effects of pressure, circulation velocity, and temperature on membrane flux and sodium chloride and Coalinga water rejections were studied. A small industrial module containing 6-C carbon supports with a 3.04 ft^2 filtration surface gave a salt rejection of 86% and a product water flux of 60 gpd/ft^2.

19530 (ORNL/TM–11730) **Potential soil contaminant levels of polychlorinated dibenzodioxins and dibenzofurans at industrial facilities employing heat transfer operations.** Korte, N.E.; Muhr, C.A.; Greene, D.W. Oak Ridge National Lab., Grand Junction, CO (United States). Apr 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92013161. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3614.

Certain manufacturing facilities formerly used large quantities of polychlorinated biphenyl (PCB) fluids in heat transfer operations. At many of these locations, operations have also involved PCB-containing electrical equipment. Commonly, over many years of plant operations, spills and leaks have resulted in PCB soil contamination. Dioxins and furans have been associated with PCB contamination in both the technical and popular press. Consequently, the need for analyses for dioxins and furans must be evaluated at locations where soils are contaminated with PCBs. This report presents an evaluation of potential dioxin and furan soil contamination based on heat transfer operations and spills from electrical equipment. The following five scenarios were examined for dioxin and furan contamination: (1) impurities in heat transfer fluids, (2) formation during heat transfer operations, (3) pyrolysis of heat transfer fluids, (4) impurities in dielectric fluids, and (5) pyrolysis of dielectric fluids. The potential contamination with dioxins and furans was calculated and compared with a 20 ppb guideline that has been used by the Centers for Disease Control for dioxin in subsoil. The results demonstrated that dioxins are formed only under pyrolytic conditions and only from the trichlorobenzenes present in dielectric fluids. Furans are found as impurities in PCB fluids but, as with dioxins, are not formed in significant quantities except during pyrolysis. Fortunately, pyrolytic conditions involving PCB fluids and soil contamination are unlikely; therefore, analyses for dioxin and furan contamination in soils will rarely be needed.

19531 (PNL-7260-HEDR) **Estimation of food consumption: Hanford Environmental Dose Reconstruction Project.** Callaway, J.M. Jr. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013016. Source: OSTI; NTIS; INIS; GPO Dep.

The research reported in this document was conducted as a part of the Hanford Environmental Dose Reconstruction (HEDR) Project. The objective of the HEDR Project is to estimate the radiation doses that people could have received from operations at the Hanford Site. Information required to estimate these doses includes estimates of the amounts of potentially contaminated foods that individuals in the region consumed during the study period. In that general framework, the objective of the Food Consumption Task was to develop a capability to provide information about the parameters of the distribution(s) of daily food consumption for representative groups in the population for selected years during the study period. This report describes the methods and data used to estimate food consumption and presents the results developed for Phase I of the HEDR Project.

19532 (PNL–7874) **Automatic measurement of water levels within the 300-FF-5 boundary.** Campbell, M.D.; Newcomer, D.R. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013160. Source: OSTI; NTIS; GPO Dep.

A network of pressure transducers with dataloggers and radio transceivers was designed to monitor water levels in 42 wells within the CERCLA 300-FF-5 boundary in the 300 Area at the Hanford Site. Automatic datalogging, radio retrieval, and computer processing provide hourly measurements that appear precise within ± 0.02 ft at a cost expected to be less than $1 each compared with $9 each for steel-tape measurements made manually. Laboratory and field results both confirm that precision is half of that originally specified. This report is intended as a reference to be used in operating and maintaining the monitoring system. The report includes water-level measurements from the first eight wells monitored.

19533 (PNL–8057) **Calculation of groundwater discharge to the Columbia River in the 100-N Area.** Gilmore, T.J.; Newcomer, D.R.; Wurstner, S.K.; Spane, F.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012618. Source: OSTI; NTIS; GPO Dep.

A computer code called WATDIS (an acronym for water discharge) was developed that, when used with the commercially available software, WATER-VEL™, calculates the volumetric discharge to a specific cross-sectional area of the aquifer. This report describes the development of the WATDIS code and its application. The development of this code is Phase 1 of a two-phased project whose objective is to estimate the amounts of radionuclides reaching the Columbia River through the unconfined aquifer as a result of "natural" conditions.

19534 (PNL–8070) **Applicability of slug interference tests under Hanford Site test conditions: Analytical assessment and field test evaluation.** Spane, F.A. Jr. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013065. Source: OSTI; NTIS; GPO Dep.

Slug interference testing may be a useful technique for characterizing the hydraulic properties of high conductivity formations where problems associated with disposal of contaminated ground water make pumping tests undesirable. The suitability of the slug interference method for characterizing the unconfined aquifer at the Hanford Site was evaluated in a two-phase investigation. The first phase consisted of an analytical assessment. Slug interference responses were predicted over the range of conditions expected for the aquifer. The effects of partial penetration, delayed-yield and aquifer anisotropy on expected test results were also evaluated and possible analytical corrections are presented. The field test evaluation was conducted at a site with two observation wells and a stress well. Results verified the analytical evaluation and gave reasonable values of hydraulic conductivity and storativity. Test design considerations that optimize the observed response are discussed.

19535 (PNL-8083-HEDR) **Literature and data review for the surface-water pathway: Columbia River and adjacent coastal areas: Hanford Environmental Dose Reconstruction Project.** Walters, W.H.; Dirkes, R.L.; Napier, B.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012169. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Hanford Environmental Dose Reconstruction Project, Pacific Northwest Laboratory reviewed literature and data on radionuclide concentrations and distribution in the water, sediment, and biota of the Columbia River and adjacent coastal areas. Over 600 documents were reviewed including Hanford reports, reports by offsite agencies, journal articles, and graduate theses. Certain radionuclide concentration data were used in preliminary estimates of individual dose for the 1964–1966 time period. This report summarizes the literature and database review and the results of the preliminary dose estimates.

19536 (PNL-SA-20550) **In situ bioremediation of Hanford groundwater.** Skeen, R.S. (Pacific Northwest Lab., Richland, WA (United States)); Roberson, K.R.; Workman, D.J.; Petersen, J.N.; Shouche, M. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9204110–3: 1992 Hazardous Materials Control Research Institute federal environmental restoration conference, Vienna, VA (United States), 15-17 Apr 1992). Order Number DE92012350. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the 40+ years of operations at the US Department of Energy's (DOE) Hanford Site. Some of these wastes were discharged to the soil column and many of the waste components, including nitrate, carbon tetrachloride (CCl_4), and several radionuclides, have been detected in the Hanford groundwater. Current DOE policy prohibits the disposal of contaminated liquids directly to the environment, and remediation of existing contaminated groundwaters may be required. In situ bioremediation is one technology currently being developed at Hanford to meet the need for cost effective technologies to clean groundwater contaminated with CCl_4, nitrate, and other organic and inorganic contaminants. This paper focuses on the latest results of an on going effort to develop effective in situ remediation strategies through the use of predictive simulations.

19537 (SAND-92-0532C) **Development and validation of a multi-site model for adsorption of metals by mixtures of minerals: 1, Overview and preliminary results.** Siegel, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Tripathi, V.S.; Rao, M.G.; Ward, D.B. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC05-84OR21400 ;AC05-76OR00033 ;AC06-76RL01830. (CONF-920761–3: 7. water-rock interaction conference, Park City, UT (United States), 9-23 Jul 1992). Order Number DE92009057. Source: OSTI; NTIS; INIS; GPO Dep.

The possibility of formulating and validating a multi-site, multisolute model for prediction of contaminant transport in groundwaters is being evaluated through experiments with simple analog systems. These systems consist of mixtures of well-characterized synthetic and natural materials in which the effects of sorption by ion exchange and amphoteric sites are isolated. Initial results are reported for studies of lead sorption by mixtures of goethite and montmorillonite, and Ni-Sr and Pb-Sr ion exchange by montmorillonite. The results of studies of simple clay-oxide mixtures indicate that the pH-dependent sorption behavior of Ni by mixtures of minerals containing amphoteric sites can be predicted from the properties of the component minerals.

19538 (SKB-TR-91-45) **The implications of soil acidification on the future HLNW repository.: Part 1: The effects of increased weathering, erosion and deforestation.** Nebot, J. (MBT Tecnologia Ambiental, Cerdanyola (Spain)); Bruno, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jul 1991. 50p. Order Number DE92506617. Source: OSTI; NTIS (US Sales Only).

We have developed a model for soil acidification and granite weathering and erosion caused by the extended use of fossil fuels. We have explored three different scenarios for depletion of fossil fuel reserves depending on how stringent is the control of the overall fossil fuel cycle. Fossil fuels reserves are expected to last for the next 300 years. Nevertheless, we have extended our calculations up to next forecasted major glaciation period (58,000 years). The results of the calculations can be summarized as follows: - For the best and average scenarios the impact of soil acidification due to fossil fuel burning, lasts only for about 500 years. The overall effect is to increase the net surface lowering (weathering + erosion + denudation) in a few percent (1-2%). - In the worst case scenario, the impact of the fossil fuel combustion on the ecosystem is irreversible. The result being that up to 30% of the expected depth of the repository (500 m) would be eroded by year 60,000. The overall ecological impact of this scenario indicates that the safety of a HLNW repository would be a lesser problem for the southern Sweden ecosystem. 41 refs., 22 figs.

19539 (SKN-51) **Geogas - a carrier or a tracer.** Hermansson, H.P. (Studsvik AB, Nykoeping (Sweden)); Chyssler, J.; Aakerblom, G.; Linden, A. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Oct 1991. 67p. Order Number DE92625797. Source: OSTI; NTIS (US Sales Only); INIS.

This report contains an account and discussion of the results of work published within the area of geogas, with particular emphasis on the conditions which would exist in a Swedish repository for spent nuclear fuel. The following issues are addressed. Is there any evidence/is it probable or improbable that a geogas flow exists? How does the flow move, what does it consists of and at what depth is it released? Is there any evidence/is it probable that matter is transported to the surface by geogas flow? What are the mechanisms that could be involved in the transport of matter by geogas? Does the composition of the gas have any bearing on the ability of the gas to transport matter? Would the gas tend to transport certain elements rather than others? What effect does the surrounding rock have on gas transport? If matter is transported upwards by geogas, is this kind of transport important compared to other means of transport of matter? The conclusion of this report is that all evidence points to the existence of a geogas flow and that nitrogen seems to be the most probable geogas candidate in a Swedish repository environment. It is difficult to estimate how quickly the gas can reach the surface from a depth of 500 m. The extreme values are 30 minutes to several thousand years. It is likely that matter is transported by geogas. Such transport is likely to be selective in a way that would favour the upward transport of colloids and other smaller particles. The most probable mechanisms is transport by ascending gas bubbles in water-filled fractures/cavities. Estimates of times, transport rates and quantities in this report are speculative and uncertain and must be regarded as an initial effort, since little or nothing is known of much of the necessary background data. For this reason, it is impossible to compare the importance of geogas transport of radionuclides from a repository with other transport mechanisms. (65 refs., 4 figs., 6 tabls.).

19540 (SKN-52) **Geogas in crystalline bedrock.** Hermansson, H.P. (Studsvik AB, Nykoeping (Sweden)); Sjoeblom, R.; Aakerblom, G. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Oct 1991. 35p. Order Number DE92623495. Source: OSTI; NTIS (US Sales Only); INIS.

Scientific literature provides conclusive evidence of gas migration through crystalline bedrock and up to the surface. In this paper, a compilation is made of significant observations of geogas. Based on these observations, and on physical and chemical principles, possible models for the behaviour of the gas are analysed and discussed. Thus, at a depth of some tens or hundreds of meters, the partial gas pressure might exceed the hydrostatic pressure, enabling the development of a gas phase. Such gas may form in fissures in the rock of perhaps 0.1 mm width. The gas deposited will attempt to minimize its surface energy. The shape assumed will depend on the geometrical constraints as well as on the specific surface energies between gas and water, gas and rock, and water and rock. For a small bubble, or a bubble of moderate size, these effects can be expected to make the bubble stay in place.

The accumulation of gas into the gas pocket will lead to the exertion of pressure onto the uppermost part of the pocket. At some stage of gas accumulation, this pressure will become sufficient for the gas to penetrate upwards through the fissure. As the gas propagates, the hydrostatic pressure will decrease and the volume of the gas will also increase. Eventually, when the surface is reached, a burst of gas may be observed. Four mechanisms have been identified that may describe how heavy elements can be transported from considerable depths to the surface by means of gas: transport through volatile compounds that dissolve in the gas, transport by elements bonded to complexing agents that are surface active and enrich themselves onto the interface between the water and the gas, flotation (bubbles attaching themselves onto particles and lifting them) and transport by aerosols that may form when gas moves rapidly through a fracture in the rock. Finally, the paper makes some recommendations to geoscientists regarding phenomena that it may be fruitful to utilize. (31 refs., 7 figs.).

19541 (SRP-HP--51) **Savannah River Plant Health Physics Department site survey report for 1951.** Reinig, W.C. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 18 Aug 1952. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011212. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Site Survey groups began operating at the Savannah River Plant in June 1951. The initial phase of the survey was concerned with the determination of the quantity of naturally occurring radioisotopes in the environs of the Savannah River Plant. These determinations were scheduled to be completed prior to the time when the quantity of radioactive effluents from the plant became significant. Sampling results are presented.

19542 (STRIPA-TR--91-13) **Improvement of high resolution borehole seismics. Part 1: Development of processing methods for VSP surveys. Part 2: Piezoelectric signal transmitter for seismic measurements.** Cosma, C. (Vibrometric Oy, Helsinki (Finland)); Heikkinen, P.; Pekonen, S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1991. 115p. Order Number DE92627869. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the high resolution borehole seismics project has been to improve the reliability and resolution of seismic methods in the particular environment of nuclear waste repository sites. The results obtained, especially the data processing and interpretation methods developed, are applicable also to other geophysical methods (e.g. Georadar). The goals of the seismic development project have been: the development of processing and interpretation techniques for mapping fractured zones, and the design and construction of a seismic source complying with the requirements of repository site characterization programs. Because these two aspects of the work are very different in nature, we have structured the report as two self contained parts. Part 1 describes the development of interpretive techniques. We have used for demonstrating the effect of different methods a VSP data set collected at the SCV site during Stage 1 of the project. Five techniques have been studied: FK-filtering, three versions of Tau-p filtering and a new technique that we have developed lately, Image Space filtering. Part 2 refers to the construction of the piezoelectric source. Earlier results obtained over short distances with low energy piezoelectric transmitters let us believe that the same principle could be applied for seismic signal transmitters, if solutions for higher energy and lower frequency output were found. The instrument which we have constructed is a cylindrical unit which can be placed in a borehole and is able to produce a radial strain when excited axially. The minimum borehole diameter is 56 mm. (au).

19543 (STRIPA-TR--91-23) **Preliminary - discrete fracture network modelling of tracer migration experiments at the SCV site.** Dershowitz, W.S. (Golder Associates Inc., Redmond, WA (United States)); Wallmann, P.; Geier, J.E.; Lee, G. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1991. 134p. Order Number DE92627872. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes a numerical modelling study of solute transport within the Site Characterization and Validation (SCV) block at the Stripa site. The study was carried out with the FracMan/MAFIC package, utilizing statistics from stages 3 and 4 of the Stripa phase 3 Site Characterization and Validation project. Simulations were carried out to calibrate fracture solute transport properties against observations in the first stage of saline injection radar experiments. These results were then used to predict the performance of planned tracer experiments, using both particle tracking network solute transport, and pathways analysis approaches. Simulations were also carried out to predict results of the second stage of saline injection radar experiments. (au) (34 refs.).

19544 (UCRL--53779-88) **Hydrology and radionuclide migration program: 1988 progress report.** Marsh, K.V. (comp.). Lawrence Livermore National Lab., CA (United States). Feb 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012423. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents results from the Lawrence Livermore National Laboratory's participation in the Hydrology and Radionuclide Migration Program at the Nevada Test Site (NTS) during fiscal year 1988. The report discusses studies at a new well 100 m down the hydrologic gradient from the previous sampling point at the Cheshire site; laboratory investigations of the mineralogical composition of NTS colloids; the strength of colloidal deposits and parameters affecting their formation and release; accelerator mass spectrometric measurements of ^{129}I in water from the Cheshire stie; ^{222}Rn concentrations in water from several pumped wells at the NTS; and a description of a new well (PM3) drilled off the NTS near Area 20. Further studies on groundwater sampled show that both technetium and iodine are quite mobile; both closely track the trend of the decreasing tritium concentration with increasing distance. Antimony and cesium concentrations decrease much more rapidly than tritium, and europium was not detected at all in the new well. Colloidal particles found in water collected from the Cheshire cavity are in size range of 0.050 to 0.003 μm and are dominated by quartz and (Ca, K) feldspars. A new well was drilled on US Air Force land adjacent to the NTS Area 20. Static water level measurements and geochemical data from this well will help to determine the extent to which Pahute Mesa base flow infiltrates Oasis Valley. Preliminary results indicate tritium concentrations in water samples from this well to be in the range of 0.1 to 0.4 pCi/ml as measured under field conditions.

19545 (UCRL-ID--105340) **A scoping study of water table excursions induced by seismic and volcanic events.** Carrigan, C.R. (Lawrence Livermore National Lab., CA (United States)); King, G.C.P.; Barr, G.E. Lawrence Livermore National Lab., CA (United States). Nov 1990. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012395. Source: OSTI; NTIS; GPO Dep.

We develop conservative models of water table response to displacements just beneath the water table simulating (1) shallow intrusion of a dike and (2) high level slip on a normal fault locked at the end. For matrix flow, we fine local water table excursions of under 10 m. in cases of isotropic permeability which includes dike inflation of 4 m and fault slips corresponding to earthquakes having a moment magnitude of 7.4. Even for enhancements of vertical permeability up to 10^4:1, excursions did not exceed 15 m which implies that pumping is strongly volume limited. We also present an analysis of upward directed flow in cracks for the case of earthquake induced pore pressure changes. For matrix properties characteristic of the Calico Hills (vitric) formation and a crack distribution bounding the potential flow capacity of published data, we estimate an upper bound of 0.25 cu m. of ground water per m. of fault length as the amount capable of being pumped to a level 250 m. above the normal water table. While the presence of even larger fractures than assumed might carry more ground water to that level an absolute upper limit of less than 50 cu. m. per m. of fault length is available to be pumped assuming a value n=0.46 for the rock porosity. For less porous rocks typical of the Topopah Springs or Tiva Canyon formations ($n \approx 0.10$) the upper limit may be reduced to less than 10 cu. m. per m. of fault length. This upper limit depends only upon strain, the height of pumping above the water table and the formation porosity.

19546 (UCRL-JC--107393) **Atmospheric reactive nitrogen: A model study of natural and anthropogenic sources and the**

role of microbial soil emissions. Dignon, J.; Penner, J.E.; Atherton, C.S.; Walton, J.J. Lawrence Livermore National Lab., CA (United States). Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911212-1: 7. world conference on the chemistry of the atmosphere: its impact on global changes, Baltimore, MD (United States), 2-6 Dec 1991). Order Number DE92010717. Source: OSTI; NTIS; GPO Dep.

Nitrogen oxides ($NO_x = NO + NO_2$) are primary pollutants which react in the atmosphere to form nitric acid (HNO_3). Nitric acid is a major contributor to acid wet and dry deposition and can also affect the reactive nitrogen nutrients in soil and ocean ecosystems. In addition, NO_x takes part in the photochemical cycle of ozone (O_3). Tropospheric O_3 is important from both an atmospheric and a biological perspective. It acts as a greenhouse gas warming the earth's surface and as a chemical oxidant which can cause injury to humans, plants, and animals. Anthropogenic sources including 22 Tg N from fossil fuel burning and 5-13 Tg N from biomass burning constitute the largest contribution [$Tg=10^{12}g$]. Less is understood abut the natural sources of NO_x and in particular the emissions from microbial activity in soils. Here we present a model calculated, seasonally and spatially resolved (1 × 1 degree), inventory of the annual soil emissions of NO_x from microbial activity from natural vegetation ecosystems. The soil emissions model addresses the emissions of soils from the natural vegetation types. Emissions from soil microbial activity have been shown to be temperature and moisture dependent.

19547 (WHC-EP-0448) **Fiscal year 1991 100 Areas CERCLA ecological investigations.** Sackschewsky, M.R.; Landeen, D.S. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012203. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the status of the ecological investigations conducted by Westinghouse Hanford Company during Fiscal Year 1991. These ecological investigations provide a basic description of the flora and fauna that inhabit the operable units, emphasizing species that have been given special status under existing state and/or federal laws. The 1991 Westinghouse Hanford Company field investigations have concentrated on the following: (1) bird surveys, (2) mammal and insect surveys, (3) vegetation surveys, and (4) vegetation sampling. Work being conducted as part of the vegetation surveys includes a biological assessment of threatened and endangered plants, which is being prepared as a separate document. Similar ecological investigations will be conducted at 100- N, K, and F operable units in 1992.

19548 (WSRC-MS-90-199X) **Multidisciplinary benefits from biomonitoring studies of cooling reservoirs.** Bowers, J.A.; Gladden, J.B. Westinghouse Savannah River Co., Aiken, SC (United States). [1990]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-901101-87: American Nuclear Society (ANS) winter meeting, Washington, DC (United States), 11-16 Nov 1990). Order Number DE92010676. Source: OSTI; NTIS; INIS; GPO Dep.

Therefore, biomonitoring studies of once-through cooling reservoirs for nuclear reactors not only provide field and laboratory information for environmental compliance, but also offer results which benefit lake and reservoir management constructs and limnetic community ecology. Biomonitoring programs have been performed at the Department of Energy's Savannah River Site to provide information fro compliance with Section 316a of the Clean Water Act. On Par Pond and Pond B comprehensive field efforts monitored nutrient chemistry, plankton populations, fisheries, benthic assemblages, and littoral zone biota from 1983 through 1985. A similar effort, begun in 1985 and continuing through 1992, is in progress on L Lake. Results have indicated that nonplanned whole-basin manipulations and the comprehensive intensity of monitoring studies offer new insights into how limnetic communities function.

19549 (WSRC-MS-91-120) **Application of inorganic-contaminated groundwater to surface soils and compliance with toxicity characteristic (TCLP) regulations.** Bergren, C.L. (Westinghouse Savannah River Co., Aiken, SC (United States)); Flora, M.A.; Jackson, J.L.; Hicks, E.M. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011018. Source: OSTI; NTIS; GPO Dep.

The Westinghouse Savannah River Company (WSRC) is currently implementing a Purged Water Management Program (PWMP) at the Savannah River Site (SRS) near Aiken, South Carolina. A variety of constituents and disposal strategies are being considered. Constituents investigated in the PWMP include radionuclides, organics, and inorganics (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag). One practical disposal alternative is to discharge purged water (all constituents below regulatory levels) to the ground surface near the monitoring well that is being purged. The purpose of this investigation is to determine if long-term application of purged water that contains inorganic constituents (below regulatory levels) to surface soils will result in the accumulation of inorganics such that the soil becomes a hazardous waste according to the Toxicity Characteristic regulations (40 CFR Part 261.24). Two study soils were selected that encompass the range of soils found at the SRS: Lakeland and Orangeburg. Laboratory batch equilibrium studies indicate that the soils, although able to retain a large amount of inorganics, will not exceed Toxicity Characteristic concentrations when subjected to the TCLP. Field studies are underway to confirm this.

19550 (WSRC-RP-89-1324) **Groundwater quality assessment/corrective action feasibility plan: New TNX Seepage Basin.** Nichols, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). 5 Dec 1989. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013140. Source: OSTI; NTIS; INIS; GPO Dep.

The New TNX Seepage Basin is located across River Road east of the TNX Area at the Savannah River Site. Currently the basin is out of service and is awaiting closure in accordance with the Consent Decree settled under Civil Act No. 1:85-2583. Groundwater monitoring data from the detection monitoring network around the New TNX Seepage Basin was recently analyzed using South Carolina Hazardous Waste Management Regulations R.61-79.264.92 methods to determine if groundwater downgradient of the New TNX Seepage Basin had been impacted. Results from the data analysis indicate that the groundwater has been impacted by inorganic constituents with no associated health risks. The impacts resulting from elevated levels of inorganic constituents, such as Mn, Na, and Total PO_4 in the water table, do not pose a threat to human health and the environment.

19551 (WSRC-TR-90-336) **Technical studies on a composite groundwater sample from F- and H-Area.** Bibler, J.P. Westinghouse Savannah River Co., Aiken, SC (United States). 15 Aug 1990. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013360. Source: OSTI; NTIS; INIS; GPO Dep.

A composite sample of groundwater from F- and H-Areas was collected by Waste Management Tech and delivered to the Savannah River Laboratory to use in preliminary experiments that would test three remediation technologies under consideration. The three technologies are pH adjustment and filtration, decontamination with a strong acid ion exchange resin, and decontamination with a chelating ion exchange resin.

19552 (Y/WM-108) **Summary report of technology demonstrations on Y-12 mixed waste soils.** Chi, L.; Kimmitt, R.R.; Madden, T.H. Oak Ridge Y-12 Plant, TN (United States). Mar 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012105. Source: OSTI; NTIS; GPO Dep.

The three companies contracted to perform the treatability studies on the Y-12 mixed wastes were free to demonstrate any technologies to render the waste non-radioactive and/or non-hazardous. All of these mixed waste studies were performed under the treatability study exclusion for RCRA hazardous wastes outlined in Code of Federal Regulations (CFR) 40 Part 261.4. Also, all wastes were analyzed to contain PCBs levels <50 ppm, and therefore not subject to TSCA regulation. The studies gave Martin Marietta Energy Systems Waste Management (WM) personnel an opportunity to test commercially available technologies on actual waste forms. During 1989 and 1990, three companies carried out technology demonstrations on samples of two types of Y-12 mixed waste: the storm sewer sediment and the oil landfarm soil. The sewer sediment, contaminated from the storm sewers of service buildings, is significantly contaminated with uranium (U), mercury (Hg), and polychlorinated biphenyls (PCBs). The oil landfarm soil, unearthed at a waste oil landfarm, is significantly contaminated with U and PCBs. These soils will be identified hereafter as Hg sediment and PCB soil, respectively. These mixed wastes were tested because of their availability and representative contamination. During 1990, additional testing was performed at the Oak Ridge National Laboratory (ORNL).

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Refer also to citation(s) 18009, 18010, 18011, 18012, 18017, 18063, 18113, 18203, 18212, 18222, 18223, 18385, 18392, 18733, 18989, 19391, 19398, 19422, 19440, 19441, 19445, 19451, 19453, 19472, 19475, 19478, 19481, 19487, 19489, 19490, 19491, 19493, 19495, 19506, 19509, 19511, 19513, 19527, 19533, 19541, 19921

19553 (ANL/CP-75636) **Quantification and reduction of the uncertainty in mass balance models by Monte Carlo analysis of prior data.** Lesht, B.M. Argonne National Lab., IL (United States). [1991]. 29p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States); National Oceanic and Atmospheric Administration, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920291-1: Approaches to reducing uncertainty in mass balance models for toxics: Lake Ontario study, Buffalo, NY (United States), 3 Feb - 5 mar 1992). Order Number DE92010278. Source: OSTI; NTIS; GPO Dep.

The general objective of this workshop is to investigate and discuss methods by which uncertainties in mass balance models for toxics in the Great Lakes may be reduced. As described by the workshop prospectus, this paper is focused on problems of reducing (and quantifying) uncertainty as they relate to "in situ field observations/system response measurements for the establishment of initial conditions, boundary conditions, calibration/confirmation data sets, and model post-audit data sets." I have taken this description to refer not only to the evaluation of uncertainty in the field observations themselves, but also to the uncertainty associated the analyses of in situ observations as they interact in the overall modeling process. Thus, I will be concerned here with quantification and reduction of uncertainty both (1) as they may be applied to descriptions of the system that is being modeled and (2) as they may be associated with model simulations.

19554 (DOE/ER/60981-2) **Measurements of surface ocean carbon dioxide partial pressure during WOCE: Technical progress report, 1 June 1991-31 May 1992.** Weiss, R.F. Scripps Institution of Oceanography, La Jolla, CA (United States). 25 Feb 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER60981. Order Number DE92011856. Source: OSTI; NTIS; GPO Dep.

Progress during the past year of research under "Measurements of Surface Ocean Carbon Dioxide Partial Pressure During WOCE" has been significant. As was described in our previous progress report, the startup phase of this research was severely frustrated by delays in the US WOCE Hydrographic Program (WHP), which in turn were caused by delays in the mid-life refit of the R/V Knorr. As a result the high latitude southeastern Pacific work (WHP lines P19S and P16S) originally scheduled for the 1990 austral summer has still not been carried out. As a substitute, the smaller R/V Thomas Washington was pressed into service during mid-1991 to carry out lower-latitude portions of the WHP P16 and P17 lines - the TUNES Expedition. Because this ship is much smaller than the R/V Knorr, she could not carry a full complement of WHP programs and seagoing personnel and was restricted by her size and the time of year to lower-latitude work. Our original proposal for carbon dioxide measurements was designed to divide the work between legs in which we participated as part of the WHP dissolved CFC program (under separate NSF funding) and legs in which we entrusted the operation of our system to other CFC or carbon dioxide laboratories with expertise in gas chromatography. Since we were not involved in any CFC work on the substituted Washington expedition, and since all the seagoing programs on the Washington were additionally stressed by a shortage of people and space, this placed our carbon dioxide program at an unwelcome disadvantage. The preliminary results for carbon dioxide and nitrous oxide are shown. We are forced to rely on spotty manual observations and station CTD temperatures to reconstruct our equilibrator temperature solubility corrections for portions of that leg. We did not get our usual reliable data return, but the results were surely worth effort, especially for this vast and rarely-visited region of the world oceans.

19555 (DOE/ER/60982-2) **Oceanic CO_2 measurements for the WOCE hydrographic survey in the Pacific Ocean, 1990-1991: Shore based analyses during Legs 1-3: Technical progress report, 1 December 1990-28 January 1992.** Keeling, C.D. Scripps Institution of Oceanography, La Jolla, CA (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER60982. Order Number DE92013064. Source: OSTI; NTIS; GPO Dep.

During the winter and spring of 1991 we made preparations for sampling on three legs of the US World Ocean Circulation Experiment in the Pacific Ocean. These transects, postponed from an original start date early in 1991, took place between May 31 to October 1. For the project, 1400 0.5 liter Pyrex sampling bottles were used for the collection of sea water. A second major pre-expedition task was the construction of a dual titration cell system of new design, as described in the original proposal and our previous semi-annual report.

19556 (DOE-HMIP-RR-91.059) **Factual biosphere database for Dounreay and the surrounding area.** Broderick, M.A. (ANS Consultants Ltd., Epsom (United Kingdom)). Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Dec 1991. 148p. Contract PECD-7/9/191. (ANS-2595-R28.). Order Number DE92626183. Source: OSTI; NTIS (US Sales Only); INIS.

This report documents from open published sources a factual database appropriate to the Dounreay region including the coastal marine environment for present day biosphere conditions. A detailed description of the present day environment in the Dounreay area is provided. This includes a description of the natural environment and climate. Site specific data required for biosphere modelling are also outlined. (author).

19557 (IG-91/01) **The tritium content of precipitation and surface water in Austria in 1990.** Rank, D.; Rajner, V.; Lust, G. Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria). 1991. 35p. (In German). Order Number DE92625829. Source: OSTI; NTIS (US Sales Only); INIS.

This report includes weighted monthly ^{3}H-means for 23 precipitation sampling stations, ^{3}H-concentrations of daily precipitation samples from the station Wien-Arsenal, and ^{3}H-concentrations of monthly samples from 17 surface water sampling stations. (authors).

19558 (NEI-DK-827) **Biological effects, within the marine environment, caused by the deposition of combustion products.** Birklund Andersen, J. Vandkvalitetsinstituttet, Hoersholm (Denmark). Jan 1992 113p. (In Danish). Contract EM-1323/88-5;Contract VKI-6744. Order Number DE92506395. Source: OSTI; NTIS (US Sales Only).

EFP-88.

The objective of the project was to investigate the effect of long term exposure to low concentrations of trace elements leaching from a nearshore reclamation site containing fly ash from coal fired power plants codisposed with fly ash and bottom ash from municipal incinerators on single species and multispecies systems of organisms. Populations of mussels, eelgrass, zoobenthos in sediment cores and test panels were exposed in a flow through system with natural sea water (9 0/00 salinity) and 6 dilutions of water from a fly ash lagoon (ranging from 2-1000 times). During exposure periods of 30 weeks, respectively 2 weeks for mussels and eelgrass, there was a direct relationship between the water concentration and the accumulation of cadmium, but this was not the case for chromium. The growth of mussels, eelgrass and the qualitative and quantitative development of the macrozoobenthos in the sediment cores was not related to the concentration of trace elements tested. The conclusions are supported by results of field monitoring of mussels and macrofauna inside and outside a fly ash lagoon. On the basis of the project and results of the ongoing monitoring in the field it is concluded that disposal in a nearshore reclamation site may increase the concentration of trace elements in organisms in the environment, but leaching of trace elements in low levels have no measureable effect on the growth and survival of the biota. Biomonitoring is necessary for detecting trace elements at low levels. Mussels and eelgrass are suitable organisms for long term (month) respectively short term (weeks) monitoring. (au) 24 refs.

19559 (NEI-SE--94) **On the carbonate systems in the Baltic and Weddell Seas: inventories and influences by man.** Ohlson, Mats. Goeteborg Univ. and Chalmers Univ. of Technology (Sweden). Dept. of Analytical and Marine Chemistry. Sep 1991. 32p. Order Number DE92506616. Source: OSTI; NTIS (US Sales Only).

The result of recent measurements of the total alkalinity and calcium in the Baltic Sea are presented. The 1986 investigation gives a significantly different calcium to total alkalinity ratio (0.691) compared to literature values (0.41). Explanations for the difference in calcium to total alkalinity ratio are offered, based on reactions in the drainage basins including decay of organic matter, precipitation of acid rain and dissolution of carbonate minerals. From later investigations a more reasonable explanation seems that the shift is due to chemical patchiness in the Baltic proper. In spite of the acidic precipitation and the increased partial pressure of carbon dioxide in the atmosphere it seems that the carbonate system has not changed dramatically during the century. Existing fluctuations are mainly depending on the season and the inflow of dense water from the Kattegat/North Sea. A carbonate model has been coupled to a one-dimensional physical and biogeochemical model of the Baltic proper. The considered regulating mechanisms have been the atmospheric carbon dioxide pressure, the river run-off concentration of total alkalinity and total carbonate, and the total alkalinity in the precipitation. With the present concentrations of the above regulating mechanisms the uptake of atmospheric carbon dioxide by the Baltic proper gets about 12 g C/m^2/year and the net sedimentation gets about 8 g C/m^2/year. Total carbonate dat from the southern Weddell Sea, collected during the Swedish Antarctic Expedition in 1988-1989, have been investigated with respect to the contribution of anthropogenic carbon dioxide. The anthropogenic carbon dioxide mean concentration varies in the different water masses from about 36 μmol/kg in the Ice Shelf water to 8 μmol/kg in the Antarctic bottom water. The evaluated annual transport of anthropogenic carbon amounts to 8x10^{12} g for this special area. 28 refs., 8 figs.

19560 (NUTEK--89-4705) **Modelling system for simulating the transport of oil and chemical spills in the sea.** Svensson, J. (SMHI, Oceanografiska laboratoriet, Goeteborg (Sweden)); Carlberg, S. NUTEK - Swedish National Board for Industrial and Technical Development, Stockholm (Sweden). 24 Jul 1991. 34p. (In Swedish). Order Number DE92506603. Source: OSTI; NTIS (US Sales Only); INIS.

The building, functioning and benefit of an easy-to-use simulation and forecasting system are described. The user cam simulate the transport of an oil or chemical spill by the wind and currents in order to plan sanitation and containment actions.

19561 (SKB-TR--91-40) **Interaction between geosphere and biosphere in lake sediments.** Sundblad, B. (Studsvik AB, Nykoeping (Sweden)); Puigdomenech, I.; Mathiasson, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 18 Dec 1990. 111p. Order Number DE92627907. Source: OSTI; NTIS (US Sales Only); INIS.

One main issue in the safety assessment of nuclear repositories, in which processes influence the distribution pattern of radionuclide elements in the biopshere when released radioactivity is carried with groundwater that penetrates through the bottom sediment of a lake. To be able to evaluate the transport of elements such as thorium, uranium, and rare earth elements (REE), sampling of lake sediment cores at different Swedish sites with different degrees of groundwater leakage was performed. Different lake sediment fractions have been identified. One fraction is related to aluminosilicates (clay and sand contents), while the other major fraction contains organic material. Enrichment of uranium is observed in areas of groundwater seepage, and U-contents is correlated to the levels of organic matter. Besides a higher mobility and enrichment of uranium compared to thorium is observed. Chondrite normalised REE sediment contents have been found higher in the most reducing sediments. The weathering and deposition processes are discussed in connection with the degree of mobility of elements. Elements as titanium, zirconium and hafnium are nearly insoluble in aqueous solutions. The immobility of these elements have been confirmed by this study. Hafnium is selected to study the differentiation of the sediment fraction originating from refractory and other physically weathered minerals. (au) (33 refs., 45 figs., 30 tbls.).

19562 (SP--91-35) **Regulations for P-marking of liming products for acidified lakes and watercourses.** Schouenborg, B. Swedish National Testing and Research Inst., Boraas (Sweden). 1991. 26p. Order Number DE92506619. Source: OSTI; NTIS (US Sales Only).

Manufacturers may, after obtaining a permit from the Swedish National Testing and Research Institute (SP), use the P-symbol to mark their products. In order to obtain a marking permit, it must be verified that the product complies with the requirements contained in a standard recognized by SP, or an equivalent normative document. An agreement must also be entered into between SP and the manufacturer concerning continuous quality inspection of the product. This report describes the requirements for P-marking of liming products for acidified lakes and watercourses. The emphasis is on functional and safety requirements including neutralizing effect, grain size distribution, moisture content and heavy metal content. The continuous in-process quality inspection is performed by the manufacturer (self inspection). The manufacturer's inspection is supervised through inspections by SP. These inspections are carried out in the plants at locations for import. The main aim of the quality inspection is to ensure that the requirements placed on the liming products are fulfilled.

19563 (UCRL-ID--104916) **Estimates of the radiological dose to people living on Bikini Island for two weeks while diving in and around the sunken ships in Bikini Lagoon.** Robison, W.L. Lawrence Livermore National Lab., CA (United States). Sep 1990. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011590. Source: OSTI; NTIS; INIS; GPO Dep.

Bikini Island and Bikini Lagoon were contaminated by fallout from nuclear weapons tests conducted at the atoll by the United States from 1946 to 1958. The second test, Baker, of the Crossroads series was an underwater detonation in 1946 that sank several ships in the lagoon, including the USS Saratoga and the Japanese battleship Nagato. The ships received high-intensity gamma-ray and neutron bombardment from the Baker test, which induced radioactivity in the metal structures. Some of the tests conducted after the Baker shot (there were 21 tests in all) injected contaminated carbonate particles into the air, some of which were deposited across the lagoon surface. Most of this contaminated soil then settled onto the ships' decks and other structures and on the lagoon bottom. These sunken ships provide an interesting location for divers. Recreational diving and swimming in and around the ships raises the question of the potential radiological dose from the radionuclides present in or on the ships and in the lagoon sediments. The purpose of this paper, therefore, is to present an analysis of the potential radiological dose to persons who would dive near the sunken ships and live on Bikini Island for a short period of time.

19564 (VTT-PUB--81) **Model studies of the transfer of radionuclides in the Finnish environment.** Korhonen, R. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1991. 116p. Order Number DE92627908. Source: OSTI; NTIS (US Sales Only); INIS.

Environmental modelling of the effects of radionuclide releases was studied. A computer model DETI2A was developed for evaluation of radionuclide transfer. The flexible structure of the model made it suitable for a wide range of applications. The model was employed to evaluate the biospheric transfer of radionuclides in two situations: 1) release cases from planned waste repositories in Finland, and 2) deposition due to the Chernobyl accident. The

Chernobyl accident provided a good opportunity to test the DETRA model, originally constructed for waste disposal applications. A study was made of some biospheric local, regional and global scale scenarios, to which releases from repositories were assumed. Drinking water from a local well and consumption of fish were the most important dose pathways. The transfer of the Chernobyl deposition in some important Finnish transfer environments was evaluated. Especially the transfer of Cs-137 in the Kymijoki watercourse, including dynamic transfer to non-predatory and predatory fish species was studied. The calculated behaviour was compared with the measured behaviour. Nuclear weapon testing fallout was also considered in the comparison studies. On the basis of validation studies it was concluded that part of the Cs-137 deposition was in insoluble form. These model assumptions give that deposition consisting of soluble Cs-l37 could cause fourfold contamination of fish per unit deposition than deposition due to the Chernobyl accident in the modelled case. Model validation was also performed within international projects, in particular by participating in the BIOMOVS project. This participation will be continued in the VAMP program. In the summary part of the thesis the main attention is paid to modelling questions, whereas in the accompanying publications the results are presented in greater detail.

19565 (WHC-SA-1378) **Determining wind spray release from effluent disposal ponds using AIRSOURC Model.** Roblyer, S.P. (Westinghouse Hanford Co., Richland, WA (United States)); Owczarski, P.C. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920328-1: 9. annual hazardous materials conference, Long Beach, CA (United States), 31 Mar - 2 apr 1992). Order Number DE92011333. Source: OSTI; NTIS; GPO Dep.

Two types of mechanisms cause release of materials from open ponds. These mechanisms are mass transfer of volatile materials and aerosol releases resulting from wind-driven sprays. The volatile releases are not the subject of this paper. However, the approach to estimating aerosol formation was unique and involved development from empirical formulas representing ocean sprays. The result of this development was the SPRAYMASS model. SPRAYMASS is a subroutine of AIRSOURC, which estimates airborne releases of chemical and radiological materials. The loss of material from open ponds experiencing strong winds is difficult both to measure and to estimate. The intent of this paper is to provide an approach to a model for estimating the formation rate of aerosols from a pond large enough to experience wind-driven sprays.

19566 (WSRC-RP-91-242) **Levels of radioactivity in fish from streams near F-Area and H-Area seepage basins.** Murphy, C.E. Jr.; Loehle, C. Westinghouse Savannah River Co., Aiken, SC (United States). May 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92009829. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes results of recent analyses of radioactivity in fish from SRS streams near the F-Area and H-Area seepage basins. Fish were collected from headwater areas of Four Mile Creek and Pen Branch, from just below the H-Area seepage basin, and from three sites downstream in Four Mile Creek. These fish were analyzed for gross alpha and gross beta radioactivity using standard EPA methods. Levels of gross alpha and nonvolatile beta radioactivity in fish were found to be comparable to levels previously reported for these sites. Gross alpha activity was not found to be influenced by Separations Area discharges. Nonvolatile beta activity was higher in the nonvolatile beta activity was attributable to Cs-137 and K-40. The dosimetric consequences of consuming fish from this area were found to be well below DOE guidelines.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 19344

5501 Behavioral Biology

Refer also to citation(s) 18222, 18223

19567 (EGG-10617-2130) **Coyote control to protect endangered San Joaquin kit foxes at the Naval Petroleum Reserves, California.** Cypher, B.L.; Scrivner, J.H. EG and G Energy Measurements, Inc., Tupman, CA (United States). [1992]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. (CONF-9203109-1: 15. vertebrate pest conference, Newport, CA (United States), 5 Mar 1992). Order Number DE92010485. Source: OSTI; NTIS; GPO Dep.

Coyote (Canis latrans) predation is the primary cause of mortality for endangered San Joaquin kit foxes (Vulpes macrotis mutica) at the Naval Petroleum Reserves in California (NPRC). Between 1980 and 1985, the kit fox population on NPRC declined approximately 66% while an increase in coyote abundance was noted. From 1985 to 1990, the US Department of Energy (DOE) sponsored a program to kill coyotes with the objective being to reduce predation on kit foxes and increase fox numbers. During the 5-year effort, 591 coyotes were killed by trapping, shooting, denning, and aerial gunning. Although scent-station indices indicated that coyote abundance declined during the period of control, the contribution of the control effort to this decline is unclear. Kit fox capture indices did not increase after control was initiated. Also, fox survival rates did not increase. The number of coyotes removed annually may not have been sufficient to effectively reduce coyote abundance. Food availability probably was the primary factor influencing the population dynamics of both predators. Control efforts have been deferred pending further consideration of the merits of control and its potential efficacy at NPRC.

5502 Biochemistry

Refer also to citation(s) 17725, 18617, 19573, 19576, 19577, 19826

19568 (CONF-8910482-1) **Imaging of DNA sequences with chemiluminescence.** Tizard, R. (Biogen, Inc., Cambridge, MA (United States)); Cate, R.L.; Ramachandran, K.L.; Wysk, M.; Bronstein, I.; Voyta, J.C.; Murphy, O.J. Tropix, Inc., Bedford, MA (United States). [1989]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-89ER80752. From Human genome I: international conference on the status and future of research on the human genome; San Diego, CA (United States); 2-4 Oct 1989. Order Number DE92011906. Source: OSTI; NTIS; GPO Dep.

We have coupled a chemiluminescent method for detecting oligonucleotides labeled with alkaline phosphatase to the genomic DNA sequencing protocol of Church and Gilbert. Images of sequence ladders obtained on x-ray film in a 30 minute exposure are comparable to those from a 40 hour exposure with 3000 Ci/mmol ^{32}P probes. Chemically cleaved DNA from a sequencing gel is transferred to a nylon membrane, and specific sequence ladders are selected by hybridization to an oligonucleotide probe conjugated either to biotin or to alkaline phosphates. If biotinylated probe is used, then an avidin-alkaline phosphatase conjugate is subsequently bound. This membrane, bearing immobilized alkaline phosphatase, is incubated with the commercially available chemiluminescent substrate disodium 3-(4-methoxyspiro[1,2-dioxetone-3,2′-tricyclo[3.3.1.1.^{3,7}]decan]-4-yl)phenyl phosphate. (AMPPD) Dephosphorylation of AMPPD leads in a two step pathway to a highly localized emission of visible light.

19569 (DOE/ER/14004-3) **The molecular characterization of the lignin-forming peroxidase: Progress summary report, April 1, 1989–March 31, 1992.** Lagrimini, L.M. Ohio State Univ., Columbus, OH (United States). Dept. of Horticulture. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14004. Order Number DE92010795. Source: OSTI; NTIS; GPO Dep.

This laboratory is committed to understanding the function of plant peroxidases via a multi-disciplinary approach. We have chosen the lignin-forming peroxidase from tobacco as the first isoenzyme to be subjected to this comprehensive approach. The goals which were set out upon the initiation of this project were as follows: (1) utilize a cDNA clone to the tobacco anionic peroxidase to generate transgenic plants which either over-produced this isoenzyme or specifically under-produced this isoenzyme via antisense RNA, (2) describe any phenotypic changes resulting from altered peroxidase expression, (3) perform morphological, physiological, and biochemical analysis of the above mentioned plants to help in determining the in planta function for this enzyme, and (4) clone and characterize the gene for the tobacco anionic peroxidase. A summary of progress thus far which includes both published and unpublished work will be presented in three sections: generation and characterization of transgenic plants, description of phenotypes, and biochemical and physiological analysis of peroxidase function, and cloning and characterization of the tobacco anionic peroxidase gene.

19570 (DOE/ER/20006–1) **Characterization of a 1,4-β-D-glucan synthase from Dictyostelium discoideum: Progress report, May 1990–January 1992.** Blanton, R.L. Texas Tech Univ., Lubbock, TX (United States). Dept. of Biological Sciences. 15 Jan 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-90ER20006. Order Number DE92011937. Source: OSTI; NTIS; GPO Dep.

Various aspects of research concerning Dictyostelium discoideum are presented. The initial focus of this project was upon: the characterization of potential probes for the cellulose synthase (antibody and nucleic acid), the determination of the cultural induction conditions of cellulose synthesis, the solubilization of the enzyme activity, the development of a non-inhibitory disruption buffer, the generation and isolation of mutant strains deficient in cellulose synthesis, and the development of the capability to determine the degree of polymerization of the in vitro product. I have briefly summarized our most significant findings with only selected data sets being shown in this report in the interest of brevity.

19571 (DOE/ER/60673–T3) **Neutron scatter studies of chromatin structure related to functions: Progress report, July 1, 1988–June 30, 1989.** Bradbury, E.M. California Univ., Davis, CA (United States). [1989]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER60673. Order Number DE92011630. Source: OSTI; NTIS; INIS; GPO Dep.

Neutron scatter studies have been performed at LANSCE, LANL and at the Institute Laue Langevin, Grenoble, France. In the previous progress report (April 1, 1988–July 1, 1988) the following objectives were listed: shape of the histone octamer; location of the N-terminal domains of histone in the nucleosome core particle (specific aim 1 of original grant proposal); effect of acetylation on nucleosome structure (specific aim 2); location of the globular domain of histone H1 (specific aim 6); and complexes of the transcription factor 3A with its DNA binding site. Progress is briefly discussed.

5504 Genetics

Refer also to citation(s) 19569, 19576, 19873

19572 (DOE/ER/13539–3) **Organization of the R chromosome region in maize: [Progress report].** Kermicle, J. Wisconsin Univ., Madison, WI (United States). Lab. of Genetics. Mar 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13539. Order Number DE92010791. Source: OSTI; NTIS; GPO Dep.

The maize R gene is said to show more phenotypic variation than any other locus in higher plants. The locus is organized on a modular basis. Individual units – termed "genic elements" since they function as independent genes – differ by regulating the presence, intensity and timing of anthocyanin pigmentation in different plant parts. A given allele may comprise only one genic element or, more commonly, an allele comprises a complex of elements, organized as a small gene family. Different numbers and combinations of even a few genic elements gives a large number of possible complexes. Following molecular cloning of R we concentrated effort initially on a genic element that confers strong pigmentation only to the kernel. The functional limits of this gene (R-sc:124) had been defined genetically by extensive mutagenesis with the transposable element Dissociation. Subsequently, a set of contiguous probes were prepared from a genomic clone of R-sc:124. This set of probes distinguishes among various R-genic elements, providing physical evidence on gene complexes whose overall organization had been determined genetically. Some surprises were in store, as detailed below. These same tools made it possible to analyze the effect of position of Ds insertion within R-sc:124 on spotting phenotype, germinal reversion rate and frequency of Ds excision. Furthermore, we are now able to address in much more detail some of the unique phenomena of R action, such as a difference in kernel phenotype when certain alleles are transmitted by ovules relative to sperm. The last category of objectives is discussed in the section entitled "updated research plan."

19573 (DOE/ER/13705–T2) **Characterization and expression of Clostridium cellulase genes: Progress report, May 1, 1987–April 30, 1989.** Doi, R.H. California Univ., Davis, CA (United States). Dept. of Biochemistry and Biophysics. [1989]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13705. Order Number DE92012231. Source: OSTI; NTIS; GPO Dep.

Progress is described on the characterization of cellulase genes of Clostridium. Purification, enzyme activity, molecular weight, and antibody development is discussed.

19574 (DOE/ER/20003–1) **Genetic studies on cytoplasmic male sterility in maize: Progress report, April 15, 1990–April 14, 1992.** Laughnan, J.R. Illinois Univ., Urbana, IL (United States). Dept. of Plant Biology. [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER20003. Order Number DE92012316. Source: OSTI; NTIS; GPO Dep.

Our research concerns the basic mechanisms of cytoplasmic male sterility (CMS) and fertility restoration in maize. The molecular determination of CMS is in the DNA of the mitochondria (mtDNA) but specific nuclear restorer-of-fertility (Rf) genes can overrule the male-sterile effect of the cytoplasm. Our approach to the study of the Rf genes is threefold. We are attempting to tag the cms-S Rf genes and the cms-T Rf2 gene with controlling elements (CEs). Since we have identified a number of spontaneous Rf genes for cms-S and have demonstrated that they are themselves transposable, we are also searching for cases in which an Rf gene is inserted into a wild-type gene. The other aspect of our research involves the nuclear control over the organization of the mitochondrial genome. We found that the changes in mtDNA organization upon cytoplasmic reversion to fertility were characteristic of the nuclear background in which the reversion event occurred. We have investigated whether these differences are a reflection of differences in the organization of the mtDNA genome before reversion.

19575 (DOE/ER/61136–1) **An improved method for producing radiation hybrids applied to human chromosome 19: Technical progress report, March 1, 1991–February 28, 1992.** Jackson, C.L. Rhode Island Hospital, Providence, RI (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61136. Order Number DE92011030. Source: OSTI; NTIS; GPO Dep.

At the initiation of the grant we had just produced radiation hybrids from a monochromosomal microcell hybrid containing human chromosome 19 as its only human component. Radiation hybrids were produced using doses of radiation ranging from 1000–8000 rads. Lethally irradiated cells were then fused to hamster recipients (CHTG49) and selected for growth in histidinol. Approximately 240 clones were isolated and 75 clones were expanded for the isolation of DNA. This report describes in situ hybridization studies and the introduction of markers into human chromosome 19.

5505 Metabolism

Refer also to citation(s) 17742, 19910

19576 (DOE/ER/13707–2) **Enzymology of biological nitrogen fixation: Annual report.** Burris, R.H. Wisconsin Univ., Madison, WI (United States). Dept. of Biochemistry. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13707. Order Number DE92012123. Source: OSTI; NTIS; GPO Dep.

Two genes involved in the regulation of nitrogenase activity, draT and draG, were cloned and found to be contiguous on the Azospirillum brasilense chromosome. The nifH gene, encoding dinitrogenase reductase, is near to draT with an intervening gap of 1.9

kb. The organization of these genes in Azospirillum lipoferum and Rhodosprillum rubrum is similar, but nifH and draT are separated by only 400 bp in the organisms. A. brasilense draTG is very similar to draTG in R. rubrum with 91.8% similarity and 85.3% identity at the amino acid level. Apparently A. brasilense uses the normal ATG initiation codon for draT, and draG. The genes for A. brasilense were able to restore function to appropriate mutants of R. rubrum. The heterologous expression of A. brasilense draTG in R. rubrum was not fully normal, as it responded more slowly to darkness and more quickly to ammonia than wild type cells. Our mutational analysis of the draTG region of A. brasilense confirms the function of these genes in the regulation of nitrogenase activity, but it also revealed minor but demonstrable differences in the control systems of R. rubrum and A. brasilense.

19577 (LBL–31592) **Nuclear magnetic resonance studies of the regulation of the pentose phosphate pathway.** Bolo, N.R. Lawrence Berkeley Lab., CA (United States). Nov 1991. 144p. Sponsored by USDOE, Washington, DC (United States); Department of Health and Human Services, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant HL07367. Order Number DE92010257. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this work is to investigate the potential for and limitations of in vivo nuclear magnetic resonance (NMR) spectroscopy for quantitation of glucose flux through the pentose phosphate pathway (shunt). Interest in the shunt is motivated by the possibility that its activity may be greatly increased in cancer and in the pathological states of cardiac and cerebral ischemia. The ability to dynamically monitor flux through the pentose shunt can give new knowledge about metabolism in pathological states. ^{13}C NMR spectroscopy was used to monitor shunt activity by determination of the ratios of [^{13}C-4] to [^{13}C-5]-glutamate, [^{13}C-3] to [^{13}C-2]-alanine or [^{13}C-3] to [^{13}C-2]-lactate produced when [^{13}C-2]-glucose is infused. These methods provide measures of the effect of oxidative stresses on shunt activity in systems ranging from cell free enzyme-substrate preparations to cell suspensions and whole animals. In anaerobic cell free preparations, the fraction of glucose flux through the shunt was monitored with a time resolution of 3 minutes. This work predicts the potential for in vivo human studies of pentose phosphate pathway activity based on the mathematical simulation of the ^{13}C fractional enrichments of C4 and C5-glutamate as a function of shunt activity and on the signal-to- noise ratio acquired in ^{13}C NMR human studies from the current literature.

5506 Medicine

Refer also to citation(s) 18432, 19048, 19253, 19288, 19874, 19913

19578 (BNL–47087) **Neutron capture therapy: Years of experimentation—Years of reflection.** Farr, L.E. Brookhaven National Lab., Upton, NY (United States). 16 Dec 1991. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92011552. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes early research on neutron capture therapy over a number of years, beginning in 1950, speaking briefly of patient treatments but dwelling mostly on interpretations of our animal experiments. This work carried out over eighteen years, beginning over forty years ago. Yet, it is only fitting to start by relating how neutron capture therapy became part of Brookhaven's Medical Research Center program.

19579 (DGEN-MN–92-3) **Radiolabeling of human platelets using four radiopharmaceuticals with Tc-99m.** Portillo L, M.C. (Unidad de Medicina Nuclear de la Direccion General de Energia Nuclear, Guatemala City (Guatemala)); Godoy, C. Direccion General de Energia Nuclear, Guatemala City (Guatemala); Hospital General San Juan de Dios, Guatemala City (Guatemala). 1991. 7p. (In Spanish). Order Number DE92626566. Source: OSTI; NTIS (US Sales Only); INIS.

The present investigation work has been done in an evaluation of four different radiopharmaceuticals with Tin II (Glucoheptonate, Pyrophosphate, Citrate and DTPA), with the purpose of determining which one of the four would be obtained a higher rate of radiolabeling of platelets with Tc-99m. In order to evaluate the four radiopharmaceuticals it was procede to the separation and labeling of the human platelets. It was worked with samples of blood from five pacients, and the platelets from each one of them were labeled with the radiopharmaceuticals-Tc-99m. Then was observed a significant difference among the four radiopharmaceuticals studied, with a reliable level of 0.05 being the Glucoheptonate-Tc-99m the best to label platelets, obtaining with the same 50.23% of labeling efficiency, while for DTPA, Pyrophosphate and Citrate, It was obtained 33.42%, 29.82% and —2.62% respectively. Also, it was studied the biodistribution of the labeled platelets, using Glucoheptonate-Tc-99m as a radiopharamceutical. The biodistribution was studied in white mice at different times and it was founded that the place of biodistribution of the labeled platelets is given in greater percentage in the liver, spleen, lungs and kydneis. (Author).

19580 (DOE/ER/60219–T2) **[Radiopharmacokinetics: Utilization of nuclear medicine]: Comprehensive progress report, [1986–1989].** Wolf, W. University of Southern California, Los Angeles, CA (United States). [1989]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-84ER60219. Order Number DE92013154. Source: OSTI; NTIS; INIS; GPO Dep.

The work performed in the 1986/1989 period can be characterized as one of testing and documenting that the Radiopharmacokinetic technique is both feasible and applicable to human studies, as well as developing spectroscopic methods for undertaking noninvasive human studies. Main accomplishments include studies which: show that drug targeting can be monitored noninvasively using radiolabeled drugs. The study that documented this finding involved an analysis of the comparative kinetics of biodistribution of ^{195m}Pt-cisplatin to brain tumors, when administered intravenously and intra-arterially; show that such differential targeting of Platinum represents a differential quantity of drug and a differential amount of the active component reaching the target site; show that in vivo NMRS studies of drugs are possible, as documented by our studies of 5-fluorouracil; show that 5-fluorouracil can be trapped in tumors, and that such trapping may be directly correlatable to patient response; show that the radiopharmacokinetic technique can also be used effectively for the study of radiopharmaceuticals used for imaging, as documented in our studies with ^{99m}T$_c$-DMSA.

19581 (DOE/ER/60719–T1) **Improved radioimmunotherapy of hematologic malignancies: [Final report].** Press, O.W. Washington Univ., Seattle, WA (United States). 24 Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-88ER60719. Order Number DE92012504. Source: OSTI; NTIS; INIS; GPO Dep.

This research project proposes to develop novel new approaches of improving the radioimmunodetection and radioimmunotherapy of malignancies by augmenting retention of radioimmunoconjugates by tumor cells. The approaches shown to be effective in these laboratory experiments will subsequently be incorporated into out ongoing clinical trials in patients. Specific project objectives include: to study the rates of endocytosis, intracellular routing, and metabolic degradation of radiolabeled monoclonal antibodies targeting tumor-associated antigens on human leukemia and lymphoma cells; To examine the effects of lysosomotropic amines (e.g. chloroquine, amantadine), carboxylic ionophores (monensin, nigericin), and thioamides (propylthiouracil), on the retention of radiolabeled MoAbs by tumor cells; to examine the impact of newer radioiodination techniques (tyramine cellobiose, paraiodobenzoyl) on the metabolic degradation of radioiodinated antibodies; to compare the endocytosis, intracellular routing, and degradation of radioimmunoconjugates prepared with different radionuclides (^{131}Iodine, ^{111}Indium, ^{90}Yttrium, ^{99m}Technetium, ^{186}Rhenium); and to examine the utility of radioimmunoconjugates targeting oncogene products for the radioimmunotherapy and radioimmunoscintigraphy of cancer.

19582 (INIS-BR–2922) **Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.** Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991 450p. (In Portuguese).

(CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Those congress present information in studies of diagnosis images and in radiotherapy. The main works include topics of neurology, gynecology, otorhinolaryngology , pneumology, urology, etc. (C.G.C.).

19583 (INIS-BR–2922, pp. 162A) **Multidisciplinary treatment of central nervous system tumours.** Epelman, S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CENTRAL NERVOUS SYSTEM/chemotherapy; CENTRAL NERVOUS SYSTEM/neoplasms; CENTRAL NERVOUS SYSTEM/radiotherapy; CHEMOTHERAPY; NEOPLASMS; RADIOTHERAPY; INFANTS

19584 (INIS-BR–2922, pp. 162B) **Radiotherapy in bone marrow transplantation (whole-body radiation).** Cestari, I. (Parana Univ., Curitiba, PR (Brazil). Hospital das Clinicas). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BONE MARROW/radiotherapy; BONE MARROW/whole-body irradiation; RADIOTHERAPY

19585 (INIS-BR–2922, pp. 162C) **Role of brachytherapy (BT) in conservative approach of penis carcinoma (ca): experience of the Institut Gustave-Roussy about 109 patients (pts).** Gerbaulet, A.; Lambin, P.; Kramar, A.; Hong, A.; Hale, C.; Court, B.; Giacchetti, S.; Delapierre, M.; Chassagne, D. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MALE GENITALS/carcinomas; MALE GENITALS/iridium 192; MALE GENITALS/radiotherapy; CARCINOMAS; RADIOTHERAPY

19586 (INIS-BR–2922, pp. 162D) **Role of brachytherapy in the treatment of oral cavity CA: experience of the Institut Gustave-Roussy on 706 patients.** Gerbaulet, A.; Haie-Meder, C.; Marsiglia, A.; Kumar, U.; Chirat, E.; Mamelle, G.; Eschwege, F.; Chassagne, D. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ORAL CAVITY/carcinomas; ORAL CAVITY/iridium; ORAL CAVITY/radiotherapy; CARCINOMAS; IRIDIUM; RADIOTHERAPY

19587 (INIS-BR–2922, pp. 162E) **Randomizated prospective study comparing hyperfractionation versus conventional radiotherapy of pharynx carcinoma EC-III and IV.** Canary, P.C.V.; Pinto, L.H.J. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHARYNX/carcinomas; PHARYNX/radiotherapy; PHARYNX; CARCINOMAS; RADIOTHERAPY; TOXICITY

19588 (INIS-BR–2922, pp. 162F) **Testicular seminoma.** Crtes Dagorret, R. (Radio Nuclear Associados, Santiago (Chile)). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Spanish). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TESTES/chemotherapy; TESTES/neoplasms; TESTES/radiotherapy; QUALITY CONTROL; SIMULATION; TESTES; CHEMOTHERAPY; NEOPLASMS; RADIOTHERAPY

19589 (INIS-BR–2922, pp. 7) **Ear diagnostic technique by computerized tomography - ear anatomy.** Sesana, W.E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. AUDITORY ORGANS/computerized tomography; AUDITORY ORGANS/diagnosis; DIAGNOSIS

19590 (INIS-BR–2922, pp. 8) **Larynx.** Marins, J.L.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LARYNX/biomedical radiography; LARYNX/computerized tomography; LARYNX; MAGNETIC RESONANCE

19591 (INIS-BR--2922, pp. 10) **Peritoneal spaces and niches.** Santos, M.B. dos. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PERITONEUM/diagnosis; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; MAGNETIC RESONANCE; PERITONEUM; DIAGNOSIS; ULTRASONOGRAPHY

19592 (INIS-BR--2922, pp. 21) **Anatomy of central nervous system.** Silva, C.F. da (Sao Paulo Univ., SP (Brazil). Inst. de Ciencias Biomedicas). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CENTRAL NERVOUS SYSTEM/anatomy; CENTRAL NERVOUS SYSTEM/computerized tomography; CENTRAL NERVOUS SYSTEM/nuclear magnetic resonance; ANATOMY

19593 (INIS-BR--2922, pp. 22) **Magnetic resonance indications in central nervous system.** Almeida Magalhaes, A.C. de. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CENTRAL NERVOUS SYSTEM/computerized tomography; CENTRAL NERVOUS SYSTEM/magnetic resonance; DIAGNOSIS

19594 (INIS-BR--2922, pp. 23) **Basic angiography of central nervous system.** Abath, C.G.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/blood vessels; BIOMEDICAL RADIOGRAPHY/central nervous system; BIOMEDICAL RADIOGRAPHY/computerized tomography; ANATOMY

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Published in summary form only. ABDOMEN/diagnosis; ABDOMEN/inflammation; ABDOMEN; DIAGNOSIS; INFLAMMATION; COMPUTERIZED TOMOGRAPHY; RADIOISOTOPES; ULTRASONOGRAPHY

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Published in summary form only. HEAD/images; HEAD/magnetic resonance; HEAD/necrosis; COMPUTERIZED TOMOGRAPHY; HEAD; IMAGES; NECROSIS; RADIOISOTOPES

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Published in summary form only. PROSTATE/carcinomas; PROSTATE/images; PROSTATE/magnetic resonance; PROSTATE; CARCINOMAS; IMAGES

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Published in summary form only. LIVER/computerized tomography; LIVER/diagnosis; LIVER/neoplasms; LIVER; DIAGNOSIS; NEOPLASMS

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Published in summary form only. LIVER/images; LIVER/magnetic resonance; LIVER; IMAGES

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Published in summary form only. BLOOD/liver; BLOOD/scintiscanning; LIVER/angiomas; LIVER/computerized tomography; BLOOD; LIVER; SCINTISCANNING; ANGIOMAS; TECHNETIUM 99 TARGET

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Published in summary form only. LIVER/computerized tomography; LIVER/contrast media; LIVER/magnetic resonance; DTPA; GADOLINIUM; INJURIES; LIVER

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Published in summary form only. LIVER/transplants; LIVER/ultrasonography; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; LIVER; TRANSPLANTS; ULTRASONOGRAPHY; VASCULAR DISEASES

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Published in summary form only. ADRENAL HORMONES/computerized tomography; ADRENAL HORMONES/magnetic resonance; ADRENAL HORMONES/neoplasms; NEOPLASMS

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Published in summary form only. BRAIN/images; BRAIN/magnetic resonance; BRAIN/neoplasms; BRAIN; IMAGES; NEOPLASMS

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Published in summary form only. SKULL/computerized tomography; SKULL/injuries; SKULL/magnetic resonance; SKULL; INJURIES

19617 (INIS-BR–2922, pp. 67) **Radiology of face breast.** Ferreira, C.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FACE/biomedical radiography; FACE/computerized tomography; FACE

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19619 (INIS-BR–2922, pp. 70) **CT and MRI of the larynx.** Weber, A.L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LARYNX/computerized tomography; LARYNX/magnetic resonance; LARYNX/neoplasms; DTPA; GADOLINIUM; LARYNX; NEOPLASMS

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Published in summary form only. EYES/computerized tomography; EYES/injuries; FACE/computerized tomography; FACE/injuries; EYES; INJURIES; FACE

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Published in summary form only. JAW/biomedical radiography; JAW/magnetic resonance; JAW

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Published in summary form only. VERTEBRAE/computerized tomography; VERTEBRAE/diseases; VERTEBRAE/magnetic resonance; VERTEBRAE; DISEASES

19623 (INIS-BR–2922, pp. 74) **CT and MRI of the neck.** Weber, A.L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NECK/computerized tomography; NECK/injuries; NECK/magnetic resonance; NECK; INJURIES

19624 (INIS-BR–2922, pp. 75) **Brain tumour imaging: pathological basis for CT and MRI.** Zimmermann, R.A. (Children's Hospital of Philadelphia, PA (USA). Dept. of Radiology). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19654 (INIS-BR-2922, pp. 150) **Monoclonal antibody, CT and MRI imaging for colo-rectal carcinoma.** Collier, B.D. (Medical Coll. of Wisconsin, Milwaukee, WI (USA)). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365-: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RECTUM/carcinomas; RECTUM/computerized tomography; RECTUM/magnetic resonance; IMAGES; RECTUM; CARCINOMAS

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19657 (INIS-BR–2922, pp. 167) **Lipomyeloschisis - review of 31 cases.** Medeiros, M.O. (Hospital Beneficencia Portuguesa, Sao Paulo, SP (Brazil)); Lira, A.C.; Aragao, M.F.V.; Mendonca, R.A.; Lima, S.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19658 (INIS-BR–2922, pp. 168) **Thoracic meningocele: presentation of two cases.** Moura, M.C.C. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Caldas, J.G.M.; Nalli, D.R.; Nogueira, R.G. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19659 (INIS-BR–2922, pp. 169) **Schistosomal myelopathy.** Castro, A.M. de; Moreira, W. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19661 (INIS-BR–2922, pp. 171) **Computerized tomography of the expansive lesions intra-rachidian: experience of HUCFF-UFRJ.** Araujo, R.C.; Bahia, P.R.V.; Seiblitz, P.M.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ARTERIES/biomedical radiography; ARTERIES/brain; ARTERIES/computerized tomography; ARTERIES; BRAIN

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Published in summary form only. BLOOD VESSELS/computerized tomography; BLOOD VESSELS/magnetic resonance; BLOOD VESSELS/malformations; MALFORMATIONS

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19666 (INIS-BR–2922, pp. 176) **Study of computerized tomography changes in intracranial cryptococcosis.** Pedrosa, M.L. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Granero, P.C.; Giannotti, I.A.; Borri, M.L.; Nogueira, R.G.; Stavale, J.N. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SKULL/computerized tomography; SKULL/yeasts; SKULL; YEASTS

19667 (INIS-BR–2922, pp. 177) **AIDS and the Chagas disease: engagement of the central nervous system.** Barcelos, I.K.; Araujo Zanardi, V. de; Maciel, J.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19668 (INIS-BR–2922, pp. 178) **Tuberculoma on plate in the central nervous system and in the orbit: relate of a case with tomography study and literature review.** Pinheiro, M.A.L. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Medicina); Santos, A.C.; Prado, C.M.A.; Trad, C.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19669 (INIS-BR–2922, pp. 181) **Neuronal migration disorders and furrowy: aspects of computerized tomography and magnetic resonance.** Aragao, M.F.V. (Hospital Beneficencia Portuguesa, Sao Paulo, SP (Brasil)); Lira, A.C.; Amaral, L.L.F. do; Medeiros, M.O.; Mendonca, R.A.; Lima, S.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SKULL/computerized tomography; SKULL/congenital malformations; SKULL/magnetic resonance; SKULL

19670 (INIS-BR–2922, pp. 182) **Septum-optic dysplasia: diagnostic by CT and/or MRI.** Picolo, J.H. (Hospital Beneficencia Portuguesa, Sao Paulo, SP (Brasil)); Mendonca, R.A.; Lima, S.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19671 (INIS-BR–2922, pp. 183) **Tomography aspects of intracranial malformations (DDI-EPM).** Borri, M.L.; Ribeiro, C.R.; Borri, A.M.; Giannotti, I.; D'Ippolito, G.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19672 (INIS-BR–2922, pp. 184) **Acoustic neurinoma: evaluation by magnetic resonance image (MRI) in 106 patients suspected of an acoustic neurinoma: correlation with the auditory evocative potentials (AEP).** Fernandes, J.G.; Duvoisin, B.; Doyon, D.; Fernandes, R.G.; Denys, A.; Sterkers, J.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19673 (INIS-BR–2922, pp. 185) **Hypothalamic hamartoma: evaluation of TC and MR.** Lira, A.C. (Hospital Beneficencia Portuguesa, Sao Paulo, SP (Brasil)); Amaral, L.L.F. do; Aragao, M.F.V.; Mendonca, R.A.; Lima, S.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19674 (INIS-BR–2922, pp. 186) **Metastases in posterior fossa: tomography aspect, incidence and first source.** Proglhof, J.E.P. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Borri, M.L.; Gianotti, I.A.; Cavalcanti, A.C.R.; Domenicis Junior, O. de; Oliveira, J.M.A. de; Borri, A.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19676 (INIS-BR–2922, pp. 188) **Ultrasonic intra-surgery: evaluation of ten neurosurgery cases.** Nalli, D.R. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Schmidt, A.E.; Proglhof, J.E.P.; Caldas, J.G.M.; Nogueira, R.G.; Lanzoni, O.P. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19677 (INIS-BR–2922, pp. 189) **Percutaneous aspiration of neurological post surgery fluid collections.** Mourao, M.L.; Pereira, E.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. CORONARIES/diseases; CORONARIES/positron computed tomography; CORONARIES/single photon emission computed tomography; COMPARATIVE EVALUATIONS; CORONARIES; DISEASES

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19708 (INIS-BR–2922, pp. 230) **Lymphography value in the staying of Hodgkin disease.** Nogueira, M.R.; Magalhaes, G.C.; Costa, E.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19709 (INIS-BR–2922, pp. 232) **Evaluation of 35 patients with adenocarcinoma gastric, diagnosed and treated in Ofyr Loyola Institute (IOL), in Belem, Para State.** Silva, A.F. da. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19710 (INIS-BR–2922, pp. 233) **Contribution of computerized tomography and ultrasonography in the pre-surgery diagnostic of peritoneal pseudomyxoma.** Santos, M.B. dos; Szejnfeld, J.; Gianotti, I.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19712 (INIS-BR–2922, pp. 251) **Aspiratory biopsy of pulmonary apex: access by ultrasonography of supra clavicular fossa.** Cazerta, N.M.C. (Universidade Estadual de Campinas, SP (Brazil). Faculdade de Ciencias Medicas); Trevisan, M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19714 (INIS-BR--2922, pp. 258) **Rhabdomyosarcoma of the prostate: relate of a case.** Siqueira Campos, C.M de; Santos, A.M.S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19717 (INIS-BR--2922, pp. 268) **Radiological aspects of fibroadenoma.** Marques Filho, C.N.; Azevedo, C.M.; Solero, T.; Toledo, L.A.L.; Rodrigues, F.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19718 (INIS-BR--2922, pp. 270) **Radiological aspects of calcifications in breast diseases: standards and signification.** Mattar, C.S.; Azevedo, C.M.; Koch, H.; Leite, E.S.; Costa, E.S.; Souza, A.M.P. de. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19719 (INIS-BR--2922, pp. 273) **Breast angiosarcoma in puerperal pregnant cycle: relate of a case.** Santos, A.M.S.; Pereira, M.A.Q.; Araujo, S.S.; Henriques, F.A.M.; Ribeiro Filho, J.A.; Segura, J.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19721 (INIS-BR--2922, pp. 275) **Computerized tomography of breast neoplasms.** Silva, E.J.; Rocha, L.A.; Simon, D.B.; Rocha, R.R.; Leal, A.T. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19722 (INIS-BR--2922, pp. 283) **Resided pulmonary cavities.** Souza, R.P. de; Barros, L.S.; Neis, M.A.; Mayo, S.V.; Mercurio Netto, S.; Soares, A.H. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19723 (INIS-BR–2922, pp. 284) **Intrathoracic neurilemmomas (Schwanomas).** Souza, R.P. de; Almeida, T.M.C. de; Sales, M.R.F.; Mayo, S.V.; Mercurio Netto, S.; Soares, A.H. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19724 (INIS-BR–2922, pp. 285) **Syndrome of vestibular aqueduct extension: tomographic diagnostic.** Oliveira, H.C. de (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnositoc por Imagem); Munhoz, M.L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19725 (INIS-BR–2922, pp. 286) **Echography analysis of hepatic focal injury: analysis of 96 cases.** Ferraz, S.M.A.; Lima, S.M.N.; Silva Filho, J.L. da; Cavalcante, S.A.F.; Falcao, A.T.M.; Rocha, D.C. da. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19726 (INIS-BR–2922, pp. 294) **Duplex mapping in carotid bifurcation disease.** Molnar, L.J. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Langer, B.; Cerri, G.G. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19727 (INIS-BR–2922, pp. 295) **Discovered in magnetic resonance on hypophysarium adenomas.** Felipe, R.G.; Hsien, C.M.; Almeida Magalhaes, A.E. de; Almeida Magalhaes, A.C.; Rosemberg, L.A.; Menezes Netto, J.R. de; Gomes, G.C.; Galves Junior, R.R.; Lo, L.S.S.; Secaf, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19728 (INIS-BR–2922, pp. 238) **The association of first hyperparathyroidism and calcified chronical pancreatitis: relate of a case.** Santos, A.M dos; Borba Filho, P.; Barros, Z.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19729 (INIS-BR–2922, pp. 293) **Xanthogranulomatosis pyelonephritis in child of four years.** Pertence, V.C. (Faculdade de Farmacia e Medicina do Triangulo Mineiro, Uberaba, MG (Brazil)); Souza, W.F. de; Silveira, L.G. da. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19730 (INIS-BR–2922, pp. 299) **First results of cerebral perfused evaluation, in patients, with HMPAO kit developed in Nuclear Medicine Center.** Buchpiguel, P.A.; Rochmann, T.M.B.; Mudarian, J.; Navarro, P.L.; Moraes, D.W.; Martin, B.W. de; Dias Neto, A.L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19731 (INIS-BR–2922, pp. 321) **Human and technical aspects on radiographic quality of mammography.** Lopes, A.A.; Schmidt, A.E.; Alves, F.F.R. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19732 (INIS-BR–2922, pp. 349) **Radiological technique in painful shoulder.** Oliveira, A.M. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Oliveira, J.L.; Lubas, S.E.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19737 (INIS-BR–2922, pp. 358) **Cerebral and cervical angiography by MR.** Bianco, E. (Hospital Nove de Julho, Sao Paulo, SP (Brazil). Centro de Tomografia por Computador); Yamashita, H.K.; Lo, L.S.; Moreira, F. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Borri, M.L.; Proglhof, J.E.P.; Magalhaes, F.W.; Ferraz, F.; Wolosker, A.M.B.; D'Ippolito, G.; Kubota, E.S.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19740 (INIS-BR--2922, pp. 361) **Relate of pontine cerebral myelinolise in child: evaluation of images in computerized tomography and magnetic resonance exams.** Borri, M.L. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Ferraz, F.; Wolosker, A.B.; D'Ippolito, G.; Kubota, E.S.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19741 (INIS-BR--2922, pp. 363) **Cutaneous hemangioma of hairy hide: relate of a case.** Ryoji, D.H. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Ponce, E.; Nalli, D.R.; D'Ippolito, G.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19742 (INIS-BR--2922, pp. 364) **Multiforme glioblastoma in infants: relate of a case.** Domenicis Junior, O. de; Proglhof, J.E.P.; Lederman, H.M.; Gianotti, I.A.; Stavale, J.N. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19744 (INIS-BR--2922, pp. 366) **Neurofibromatosis.** Villas Boas, C.L.P.; Souza, A.M.P. de; Andrade, W.M. de. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19746 (INIS-BR--2922, pp. 368) **Image diagnostic of dural breast thrombosis.** Caldas, J.G. (Hospital do Servidor Publico Estadual de Sao Paulo, SP (Brazil). Servicos de Radiologia e Neurocirurgia); Silva, H.A. da; Botelho, R.; Cecilio, S.A.J.; Settani, F.A.P. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19747 (INIS-BR--2922, pp. 369) **Tomographic anatomy of temporal bone; Part 1: axial plane.** Oliveira, H.C. de (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Kubota, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19748 (INIS-BR–2922, pp. 370) **Tomographic anatomy of temporal bone; Part 2: coronal plane.** Oliveira, H.C. de (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Kubota, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19749 (INIS-BR–2922, pp. 371) **Otomastoiditis by Lagochilascaris Minor: evaluation by computerized tomography.** Oliveira, H.C. de (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem). Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19751 (INIS-BR–2922, pp. 379) **Pseudoaneurysm of superficial femoral arteries: documentation of a case.** Freire, M.V.; Fernandes, C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19755 (INIS-BR–2922, pp. 387) **Tomographic aspects of rhabdomyosarcomas.** Gomes, R.L.E.; Gebrim, H.M.M.; Souza Rocha, M. de; Cerri, G.G.; Magalhaes, A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19756 (INIS-BR–2922, pp. 388) **Osteoclerosis myeloma.** Nascimento, N.B.; Brincas, S.M.; Soares, A.H.; Eliaschewitz, F.G.; Zampieri Filho, J.P.; Barragan Filho, E.G. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. ABDOMEN/skeletal diseases; ABDOMEN/tomography; SKELETAL DISEASES/biomedical radiography; SKELETAL DISEASES/neoplasms; ABDOMEN; TOMOGRAPHY; BONE MARROW; NEOPLASMS

19757 (INIS-BR–2922, pp. 389) **Bone densitometry by computerized tomography.** Perdigao, F.J.L.; Tenorio, D.A.; Rocha, D.C. da. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. OSTEODENSITOMETRY/computerized tomography; BONE MARROW; CALCIUM; OSTEODENSITOMETRY

19758 (INIS-BR–2922, pp. 391) **Colour Doppler in diagnosis of breast tumours.** Rocha, D.C. da. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. MAMMARY GLANDS/biomedical radiography; MAMMARY GLANDS/neoplasms; MAMMARY GLANDS/ultrasonography; DOPPLER EFFECT; NEOPLASMS; ULTRASONOGRAPHY

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Published in summary form only. SURGICAL MATERIALS/computerized tomography; ABDOMEN; ULTRASONOGRAPHY

19760 (INIS-BR–2922, pp. 302) **Cerebral SPECT - 99mTc HMPAO in Moyamoya disease.** Kato, M.; Yamada, A.S.; Goncalves, C.; Watanabe, T.; Yamaga, L.Y.I.; Matsushita, H.; Buchpiguel, C.A.; Hironaka, F.H.; Magalhaes, A.E.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. BRAIN/blood vessels; BRAIN/diseases; BRAIN/single photon emission computed tomography; BRAIN; DISEASES; TECHNETIUM 99 TARGET

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Published in summary form only. EPILEPSY/scintiscanning; EPILEPSY/single photon emission computed tomography; EPILEPSY/technetium 99 target; BRAIN; EPILEPSY; SCINTISCANNING; PERFUSED ORGANS

19762 (INIS-BR–2922, pp. 301) **Cerebral SPECT on presurgery evaluation in epileptic patients.** Almeida Filho, P.J.; Buchpiguel, P.A.; Cuckier, A.; Itaya, L.Y.; Watanabe, T.; Hironaka, F.H.; Marino Junior, R.; Pinheiro, E.; Magalhaes, A.E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. EPILEPSY/brain; EPILEPSY/single photon emission computed tomography; EPILEPSY; BRAIN; MAGNETIC RESONANCE; POSITRON COMPUTED TOMOGRAPHY; SURGERY; TECHNETIUM 99 TARGET

19763 (INIS-BR–2922, pp. 303) **Pulmonary scintiscanning with glucoheptonate-Tc99m in patients with paracoccidioidomycosis: preliminary results.** Lang, W.S.; Mendes, R.P.; Viterbo, B.G.; Meira, D.A.; Pereira, P.C.M.; Kiy, Y. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.
Published in summary form only. LUNGS/scintiscanning; LUNGS/technetium 99 target; LUNGS/yeasts; LUNGS; SCINTISCANNING; YEASTS

19764 (INIS-BR–2922, pp. 305) **Pharmacological stresses associated to myocardial perfused scintiscanning: adverse reactions and hemodynamic changes.** Cruz, S.H.; Chalela, W.A.;

Izaki, M.; Soares Junior, J.; Moffa, P.J.; Moraes, A.P.; Bellotti, G.; Pileggi, F.; Meneghetti, J.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BIOLOGICAL STRESS/coronaries; BIOLOGICAL STRESS/drugs; BIOLOGICAL STRESS/scintiscanning; CORONARIES/diseases; CORONARIES; DRUGS; SCINTISCANNING; DISEASES; DIAGNOSIS; THALLIUM 201

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19766 (INIS-BR–2922, pp. 310) **Immunoscintiscanning with 111In-anti-CEA in narrow carcinoma of thyroid.** Watanabe, T.; Buchpiguel, C.A.; Yamaga, L.Y.; Ezabella, M.C.L.; Pinheiro, E.A.; Hironaka, F.H.; Dias Neto, A.L.; Magalhaes, A.E.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19767 (INIS-BR–2922, pp. 311) **Value of immunoscintiscanning in the colon-rectum tumours investigation: preliminary results.** Buchpiguel, C.A. (and others); Campos, F.G.; Morais Filho, C.P. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19768 (INIS-BR–2922, pp. 312) **Immunoscintiscanning in ovary neoplasms: preliminary study using CA125 monoclonal antibody.** Yamaga, L.I. (and others); Buchpiguel, C.; Watanabe, T. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. OVARIES/immune serums; OVARIES/neoplasms; OVARIES/scintiscanning; COMPUTERIZED TOMOGRAPHY; OVARIES; NEOPLASMS; SCINTISCANNING; ULTRASONOGRAPHY

19769 (INIS-BR–2922, pp. 313) **Clinical comparison of MDP, HMPAO and Tc-99m labelled leukocytes in detection of osteomyelitis.** Gutfilen, B. (and others); Pellini, M.P.; Amarante, J.L. M. Jr. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19770 (INIS-BR–2922, pp. 314) **Determination of the representative regression equation from bone densitometry in function with age.** Alonso, G.; Alonso, C.R.; Martins, L.R.F.; Blomer, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19771 (INIS-BR–2922, pp. 315) **Evaluation of normal values of bone densitometry in feminine brazilian population.** Alonso, C.R.; Alonso, G.; Martins, L.R.F.; Blomer, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19772 (INIS-BR–2922, pp. 316) **Utilization of 51Cr-EDTA in subcutaneous injection for evaluation of glomerulate filtration rhythm: method standardization.** Monteiro, M.C.A. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Alonso, G.; Pereira, A.B.; Fortes Junior, J.P.; Barbieri, A.; Castiglioni, M.L.V. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19773 (INIS-BR–2922, pp. 317) **Kidney scintiscanning with captopril in renal vascular arterial hypertension diagnosis: description of a case.** Hollanda, R. de; Giamberardino, D.D.; Bley, P.C.P.; Sandrini, R.A.; Kanegusuku, J. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19774 (INIS-BR–2922, pp. 328) **Radiotherapy results of lung cancer treatment in small cells.** Gomes, H.C. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Carvalho, H.A.; Takagaki, T.Y. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19775 (INIS-BR–2922, pp. 330) **Radiotherapeutical treatment of thymoma: retrospective study.** Aguilar, P.B. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Gomes, H.C.; Carvalho, H.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19776 (INIS-BR–2922, pp. 332) **Comparative study between coadjuvant methods and surgery in keloid treatment.** Carvalho, H.A. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Gonzalez, M.A.; Egreja, R. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. VERTEBRAE/neoplasms; VERTEBRAE/radiotherapy; VERTEBRAE; NEOPLASMS; RADIOTHERAPY

19777 (INIS-BR–2922, pp. 333) **Carcinoma of endometrium: preliminary results of treatment with brachytherapy of high rate dose.** Aisen, S. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Esteves, S.C.B.; Carvalho, H.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. UTERUS/carcinomas; UTERUS/external irradiation; UTERUS/radiotherapy; UTERUS; CARCINOMAS; RADIOTHERAPY

19778 (INIS-BR–2922, pp. 337) **Use of mixed beam on post-surgery radiotherapy in salivary glands tumours with high degree of malignity.** Antonangelo Filho, A. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Haddad, C.; Molle, R.D. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19779 (INIS-BR–2922, pp. 338) **Carcinoma of uterine colon: preliminary results of treatment with brachytherapy of high rate dose.** Aisen, S. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Esteves, S.C.B.; Carvalho, H.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19780 (INIS-BR–2922, pp. 339) **Radiotherapy randomizated study versus radiotherapy + chemotherapy in epidermoid carcinoma of intrathoracic esophagus.** Araujo, C.M.M.; Pinto, L.H.J.; Souhami Filho, L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology* *from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19781 (INIS-BR--2922, pp. 340) **Experience with brachytherapy of high ratio dose in five cases of neoplasias: penis, head and neck and rectum/c. anal.** Esteves, S.C.B. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Carvalho, H.A.; Aisen, S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MALE GENITALS/dose rates; MALE GENITALS/neoplasms; MALE GENITALS/radiotherapy; NEOPLASMS; RADIOTHERAPY

19782 (INIS-BR--2922, pp. 342) **Post- surgery treatment of uterine colon with brachytherapy of high rate dose.** Esteves, S.C.B. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Aisen, S.; Carvalho, H.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. SKELETON/metastases; SKELETON/radiotherapy; PATHOLOGY; SKELETON; METASTASES; RADIOTHERAPY

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19786 (INIS-BR--2922, pp. 331) **Brachytherapy of high rate dose in esophagus cancer.** Carvalho, H.A. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Esteves, S.C.B.; Aisem, S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ESOPHAGUS/neoplasms; ESOPHAGUS/radiotherapy; ESOPHAGUS; NEOPLASMS; RADIOTHERAPY

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19788 (INIS-BR--2922, pp. 401) **Epidermoide carcinoma of anal canal: relate of a case.** Rubez, A.D. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Costacurta, M.; Figueiredo, R.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao*

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19789 (INIS-BR--2922, pp. 414) **Renal oncocytoma: relate of two cases and literary review.** Matsumoto, C.A. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Granero, P.C.; D'Ippolito, G.; Silva, L.C.; Ryoji, D.H.; Ponce, E.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19790 (INIS-BR--2922, pp. 415) **Malacoplakia from bladder: relate of a case simulating neoplasia.** Cunha, R.M. da (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Granero, P.C.; Silva, L.C.; Szejnfeld, J.; Ryoji, D.H.; Ajzen, S. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19791 (INIS-BR--2922, pp. 416) **Xanthogranulomatosis pyelonephritis: relate of a case and literary review.** Shigueoka, D.C. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Granero, P.C.; Silva, L.C. da; Camargo, R.T. de; D'Ippolito, G.; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19792 (INIS-BR--2922, pp. 417) **Extra-renal Wilms tumors: relate of a case.** Barcelos, I.K.; Araujo Zanardi, V. de; Brito Pacheco, E.M. de. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19793 (INIS-BR--2922, pp. 418) **Tomographic aspects of adrenal pathologies.** Gebrim, E.M.M.; Gomes, R.L.E.; Souza Rocha, M. de; Cerri, G.G.; Magalhaes, A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ADRENAL GLANDS/computerized tomography; ADRENAL GLANDS/pathology; PATHOLOGY; PATIENTS

19794 (INIS-BR--2922, pp. 421) **Anatomic correlation of upper mediastinum structures: axial CT and MR in multiple planes.** Yamashita, H.K. (Hospital Nove de Julho, Sao Paulo, SP (Brazil). Centro de Tomografia por Computador); Moreira, F.; Bianco, E.; Kambara, A.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19795 (INIS-BR--2922, pp. 422) **Dirofilaria immitis: presentation of a case.** Figueiredo, R. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Oliveira, J.M.A. de; Rubez, A.D.; Lederman, H. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LUNGS/biomedical radiography; LUNGS/computerized tomography; LUNGS/parasitic diseases; LUNGS

19796 (INIS-BR--2922, pp. 423) **Thymic cyst: correlation of XR, USG and TC.** Suslik, C.A.; Francisco Neto, M.J.; Kawakami, L.; Rocha, M.S.; Cerri, G.G.; Magalhaes, A.E.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365--: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao*

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19797 (INIS-BR–2922, pp. 424) **Initial malign teratoma of mediastinum.** Marques Filho, C.N.; Leite, E.S.; Moreira, D.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19798 (INIS-BR–2922, pp. 425) **Initial Hodgkin disease of lung.** Alves, M.M.R. (Instituto Nacional do Cancer, Rio de Janeiro, RJ (Brazil)); Costa, E.S.; Costa, M.A. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LUNGS/biomedical radiography; LUNGS/computerized tomography; LUNGS/hodgkins disease; LUNGS

19799 (INIS-BR–2922, pp. 427) **Askin tumor.** Silva Filho, A.O. da; Kataoka, K.; Souza, R.P. de; Mayo, S.V.; Mercurio Netto, S.; Soares, A.H. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19800 (INIS-BR–2922, pp. 429) **Takayasu arteritis - aneurysmatic form: relate of a case.** Ponce, E. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Shigueoka, D.C.; Rioji, D.H.; Fonseca, J.H.P. da; Gianotti, I.A.; Yamashita, H.; Bufolo, E. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian conqress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19801 (INIS-BR–2922, pp. 431) **Retroperitoneal ganglioneuroma.** Scaranelo, A.M.; Brandao, J.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19802 (INIS-BR–2922, pp. 433) **Cystic lymphangioma of mediastinum: relate of a case.** Menasce, S. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil). Dept. de Diagnostico por Imagem); Domenicis Junior, O. de; Lederman, H.M. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19803 (INIS-BR–2922, pp. 435) **Intra-muscular lipoma of the face.** Souza, A.M.P. de; Brito, A.; Villas Boas, C.L. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19804 (INIS-BR–2922, pp. 436) **Magnetic resonance in malformations of lumbosacral column.** Rosemberg, L.A.; Magalhaes, A.C.A.; Forni, S.S.; Felipe, R.C.; Haien, C.M.; Gomes, G.C. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

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19805 (INIS-BR–2922, pp. 438) **Neuroblastoma: initial presentation in mandible.** Scatigno Neto, A.; Turrini, E.; Carvalho, I.E.; Lerner, J.S.; Ferreira, D.L.; Valle, M.J.R.; Barros, N.G. de. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365–: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from

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19806 (INIS-GB-428) **Medical radiation.** At-a-Glance series. National Radiological Protection Board, Chilton (United Kingdom). [1992] 6p. Order Number DE92628097. Source: OSTI; NTIS (US Sales Only); INIS.

Folded leaflet.

This leaflet in the At-a-Glance Series describes the medical use of X-rays, how X-rays help in diagnosis, radiation protection of the patient, staff protection, how radioactive materials in nuclear medicine examinations help in diagnosis and the use of radiation in radiotherapy. Magnetic resonance imaging, a diagnostic technique involving no ionizing radiation, is also briefly examined. The role of the NRPB in the medical use of radiation is outlined. (UK).

19807 (INIS-mf-13183) **SAAPMB summer school and congress.** South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Medical and health physics are covered by the papers and posters presented at this congress. A third group within the Association, the group of Radiobiological Scientists, was expected to be formed during this congress. 67 articles have been indexed (44 papers and 23 poster presentations), and 8 articles have been considered to be out of scope for INIS.

19808 (INIS-mf-13183, pp. 43) **The use of stabilizing agents in ^{99m}Tc labelling kits.** Van der Walt, T.N. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Fourie, P.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. LABELLED COMPOUNDS/stability; TECHNETIUM 99/labelling; ASCORBIC ACID; BABOONS; COLLOIDS; DIAGNOSIS; DTPA; ISOTONIC SOLUTIONS; STABILITY; NUCLEAR MEDICINE; PLURONICS; LABELLING

19809 (INIS-mf-13183, pp. 34) **Film dosimetry for electron beams.** Engelbrecht, J.S. (Orange Free State Univ., Bloemfontein (South Africa). Dept. of Biophysics); Naude, H.; Willemse, C.A.; Loetter, M.G. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. FILM DOSIMETRY/depth dose distributions; FILM DOSIMETRY/electron beams; BASIC; CALIBRATION; DENSITOMETERS; IONIZATION CHAMBERS; LINEAR ACCELERATORS; NEOPLASMS; OPACITY; PATIENTS; RADIATION DOSE DISTRIBUTIONS; RADIATION DOSES; SPATIAL RESOLUTION; THERAPY; X RADIATION

19810 (INIS-mf-13183, pp. 34) **Dose-gradient dependence of wedge factors used in photon beams?.** Groenewald, W.A. (Tygerberg Hospital, Bellville (South Africa). Dept. of Medical Physics); Pistorius, S. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIATION DOSES/filters; RADIATION DOSES/photon beams; COBALT 60; MEV RANGE 01-10; MEV RANGE 10-100; PATIENTS; FILTERS; RADIOTHERAPY; X RADIATION

19811 (INIS-mf-13183, pp. 35) **Optimizing shielding blocks and field joints in radiotherapy.** Coetzee, S. (H.F. Verwoerd Hospital, Pretoria (South Africa)); Pienaar, C.P.; Fourie, O.L.; Van Rensburg, A.J.; Alberts, A.S. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIOTHERAPY/shielding; OPTIMIZATION; RADIATION DOSES; RADIATION EFFECTS; RADIOTHERAPY; SHIELDING; SCATTERING; THERAPY; TOXICITY

19812 (INIS-mf-13183, pp. 35) **The equivalent squares for blocked fields.** Keddy, R.J. (Johannesburg Hospital (South Africa). Dept. of Medical Physics); Van der Merwe, D.G.; Scott, M.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. THERAPY/channeling; ALGORITHMS; COMPUTERS; HOSPITALS; PLANNING; SOUTH AFRICAN ORGANIZATIONS; THERAPY; CHANNELING

19813 (INIS-mf-13183, pp. 37) **Preparation of ^{153}Sm-EDTMP for systemic radioisotope therapy of primary and metastatic bone cancer.** Louw, W.K.A. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Forsyth, O.E.; Fouche, F.J.; Knoesen, O.; Fourie, P.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIOTHERAPY/samarium 153; RADIOTHERAPY/skeletal diseases; BETA PARTICLES; BONE SEEKERS; CHEMICAL PREPARATION; EMISSION; EUROPIUM 152; GAMMA RADIATION; LABELLING; METASTASES; RADIATION DOSES; RADIONUCLIDE KINETICS; RADIOPHARMACEUTICALS; RADIOTHERAPY; RHENIUM 186; SAMARIUM PHOSPHATES; SCINTISCANNING; TECHNETIUM 99

19814 (INIS-mf-13183, pp. 46) **Computer assisted instruction: CT and MR image reconstruction.** Jelinek, G.J. (Medical Univ. of Southern Africa, Pretoria (South Africa). Dept. of Medical Physics); Chamberlain, A.C.; Strydom, W.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. COMPUTERIZED TOMOGRAPHY/image processing; MAGNETIC RESONANCE/image processing; COMPUTER CODES; DATA ACQUISITION; EDUCATION; IMAGE SCANNERS; MICROCOMPUTERS

19815 (INIS-mf-13192, pp. 278) **Advanced X-ray medical systems for chest imaging.** Svobodova, J. (Vysoke Uceni Technicke, Brno (Czechoslovakia)). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CHEST/biomedical radiography; CHEST; X RADIATION

19816 (INIS-mf–13196) **Chest X-ray : a cost-diagnostic benefit analysis: Conventional versus 100 mm image Intensifier Radiography.** Winter, L.H.L. Rijksuniversiteit Utrecht (Netherlands). 13 Dec 1991 188p. Order Number DE92628099. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summary in Dutch and List of publications and presentations by the author.

Although plain chest radiography is one of the most useful diagnostic tools available to the physician, this procedure has not evolved into a consistent method. Two Large Field of View Image Intensifiers (LFOV-II) became available; the large imaging area makes them suitable for chest imaging. Both modalities supply 100 mm images to the radiologist. In this thesis the 'diagnostic benefits and 'costs' of these modalities are evaluated and related to the 'gold' standard (conventional full-size). The emphasis is on diagnostic image quality using phantoms for observer performance qualities. (author). 170 refs.; 21 figs.; 47 tabs.

19817 (KURRI-TR–356) **Investigation for the extended application of melanoma Boron Neutron Capture Therapy.** Mishima, Yutaka (Kobe Univ. (Japan). School of Medicine). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Nov 1991. 319p. (In Japanese, English). Order Number DE92514983. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the Part B of the Progress Report (III) which includes our latest research results focusing mainly on the successful treatment of the first human melanoma patient who had metastasis in the scalp region. We also include the subsequent clinical treatment of various types of human primary melanoma lesions and the additional basic investigations necessary to perform the treatment. (J.P.N.).

19818 (KURRI-TR–357) **Selective thermal neutron capture therapy of malignant melanoma using melanogenesis-seeking ^{10}B-compounds.** Mishima, Yutaka (Kobe Univ. (Japan). School of Medicine). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Nov 1991. 204p. (In Japanese, English). Order Number DE92514984. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the Part B of the Progress Report (III) which includes our latest research results focusing mainly on the successful treatment of the first human melanoma patient who had metastasis in the scalp region. We also include the subsequent clinical treatment of various types of human primary melanoma lesions and the additional basic investigations necessary to perform the treatment. (J.P.N.).

19819 (LBL–31457) **Monte Carlo optimization of depth-of-interaction resolution in PET crystals.** DeVol, T.A. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering); Moses, W.W.; Derenzo, S.E. Lawrence Berkeley Lab., CA (United States). Nov 1991. 5p. Sponsored by USDOE, Washington, DC (United States); Department of Health and Human Services, Washington, DC (United States); Oak Ridge Associated Universities, Inc., TN (United States); National Cancer Inst., Bethesda, MD (United States). DOE Contract AC03-76SF00098. Grant P01-HL25840;Grant R01-CA48002. (CONF-911106–92: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92011147. Source: OSTI; NTIS; GPO Dep.

The light distribution along one edge of a PET scintillation crystal was investigated with a Monte Carlo simulation. This position-dependent light can be used to measure the 511 keV photon interaction position in the crystal on an event by event basis, thus reducing radial elongation. The expected full width at half maximum (FWHM) of the light distribution on the 3 x 30 mm^2 surface of a 3 x 10 x 30 mm^3 bismuth germanate (BGO) crystal surrounded by a diffuse reflector was determined to be 3.0 mm. This light distribution does not change as the width (originally 3 mm) is varied from 1 to 6 mm, but decreases monotonically from 3.0 to 1.8 mm FWHM as the height (originally 10 mm) is reduced to 3 mm. Other geometrical modifications were simulated, including numerous corner reflectors on the opposing 3 x 30 mm^2 surface, which reduced the FWHM to 2.4 mm. The response of a dual wedge photodiode combined with the predicted light distribution for the 3 x 10 x 30 mm^3 BGO simulation crystal results in an expected depth of interaction resolution of 7.5 mm FWHM.

19820 (LUMEDW-MEKP–1019-1-104-1991) **Urinary trypsin inhibitor - an experimental and clinical study.** Berling, B.M. Lund Univ., Malmoe (Sweden). Depts. of Surgical Pathophysiology and Anaesthesiology. 1991. 41p. Order Number DE92628116. Source: OSTI; NTIS (US Sales Only); INIS.

The urinary trypsin inhibitor (UTI) is an acid stable proteinase inhibitor present in blood and urine. It was purified from urine using affinity chromatography, ion exchange chromatography and gel filtration. Two forms of UTI were present in urine, A and B. A radioimmunoassay for measurement of UTI in urine and plasma was performed. The normal level of UTI in plasma and serum was about 2 mg/l. The normal excretion in urine was about 8 mg per 24 hours. The plasma and urine levels of UTI were studied in patients with acute pancreatitis and in patients undergoing cholecystectomy. Uremic patients had a marked increase of UTI in plasma compatible with decreased glomerular filtration. In samples from healthy persons as well as from patients only inhibitor A was found. Inhibitor B has recently been renamed bikunin because of its two Kunitz-type inhibiting domains. Inhibitor A might be called tetrakunin. Radioactively labeled UTI (inhibitor A) was injected intravenously in three male volunteers. The plasma half-life of ^{125}I UTI was 2 hours. Free biologically active inhibitor was found in the urine during the first four hours after injection. The organ distribution of intravenously injected ^{125}I UTI was studied in rats. Fifteen minutes after injection the major part of the radioactivity was found in the kidneys, suggesting that the kidneys are the primary site of UTI metabolism. Using immunohistochemical techniques UTI was found in the proximal tubules of the normal human kidney further indicating the tubular reabsorption and methabolisms of UTI.

19821 (NEI-NO–193) **Ultrasonography versus intravenous urography: Value in urological disease.** Aslaksen, A. Bergen Univ. (Norway). 1991 87p. Order Number DE92628100. Source: OSTI; NTIS (US Sales Only); INIS.

Reprints of six previously printed papers are attached.

The present study was performed to compare the clinical value of urography and ultrasonography in a non-selected group of patients referred for urography to a university hospital. The conslusions and clinical implications of the study are as follows: Intravenous urography remains the cornerstone imaging examination in the evaluation of ureteral calculi. Ultrasonography is a valuable adjunct in cases of non- visualization of the kidneys, in distal obstruction and known contrast media allergy. When women with recurrent urinary tract infection are referred for imaging of the urinary tract, ultrasonography should be used. Ultrasonography should replace urography for screening of non-acute hydronephrosis like in female genital cancer and benign prostate hyperplasia. There is good correlation between urography and ultrasonography in assessing the degree of hydronephrosis. However, more researh on the relationship between hydronephrosis and obstruction is necessary. Ultrasonography should be used as the only imaging method of the upper urinary tract in patients with microscopic hematuria. In patients less than 50 years with macroscopic hematuria, ultrasonography should be used as the only imaging of the upper urinary tract, and an examination of the urinary bladder should be included. In patients over 50 years, urography supplied with ultrasonography should be used, but more research is necessary on the subject of imaging method and age. 158 refs.

19822 (NEI-NO–194) **Magnetic iron oxide for contrast-enhanced MR imaging.** Fahlvik, A.K. Oslo Univ. (Norway). May 1991 96p. Order Number DE92628101. Source: OSTI; NTIS (US Sales Only); INIS.

Reprints of six previously printed papers are attached.

The main objective of this experimental work has been to study the biological fate and the contrast enhancing potential of a model preparation of magnetic iron oxide (MSM) after intravenous injection to rodents. This was achieved by: Studying in vitro contrast efficacy of various magnetic iron oxide preparations by relaxation analysis. Studying in vivo contrast efficacy of MSM by relaxation analysis and NMR imaging. Studying the biodistribution and bioelimination of MSM in independent experiments using relaxation analysis, radioactivity studies and histological techniques. Studying interactions of MSM with target cells and target organelles using ex vivo techniques. Based on the presented experimental study, the MSM model preparation of magnetic iron oxide seems to fulfill basic requirements of NMR contrast agents: efficient proton relaxation, specific in vivo distribution, and biological tolerance. 177 refs., 5 figs., 2 tabs.

19823 (ORNL/TM–12054) **Nuclear medicine program progress report for quarter ending December 31, 1991.** Knapp, F.F. Jr.; Ambrose, K.R.; Callahan, A.P.; McPherson, D.W.; Mirzadeh, S.; Srivastava, P.C.; Hasan, A.; Lambert, C.R.; Lambert, S.J.; Rice, D.E. Oak Ridge National Lab., TN (United States). Apr 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012619. Source: OSTI; NTIS; GPO Dep.

This report presents information on (1) a new improved synthesis of carrier-free rhenium-188-labeled Re(V) dimercaptosuccinic acid (DMSA) complex as a potential therapeutic agent for treatment of thyroid medullary carcinoma; and (2) the synthesis and evaluation of a series of iodine-125-labeled analogues of altanserine for imaging of serotonin receptors.

19824 (UCRL-ID–110116) **Project implementation plan: Quality assurance for gamma knives: FIN L-1938-1: Revision 3.3.** Lawrence Livermore National Lab., CA (United States). 1 Mar 1992. 252p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011591. Source: OSTI; NTIS; GPO Dep.

The gamma knife is a treatment machine used for stereotactic brain irradiation. It is manufactured and marketed by Elekta Instruments. The treatment goal is to deliver a high dose of radiation to a small, discrete volume with minimal radiation to adjacent normal brain tissue. The radiation unit contains 201 cobalt-60 sealed sources distributed in a hemisphere located within the central body of the unit. The beams from each individual source are collimated and converge at a focal point at the center of the radiation unit. The patient's head is positioned in a collimator helmet such that the target volume in the brain corresponds to the beam focal point. At the time of initial loading the total cobalt 60 activity is approximately 5400-6600 curies. Current Nuclear Regulatory Commission (NRC) Regulations address quality control procedures for conventional cobalt-60 teletherapy devices, but do not address comparable procedures for gamma knives. Also reports received by the NRC indicate that there are some cases of teletherapy misadministrations that have resulted from equipment malfunction and from errors in treatment planning and physical measurements. The NRC believes that comparable events may occur with gamma knives. The objectives of this project are: (1) to identify the device review or registration requirements; (2) to identify quality control/calibration procedures for acceptance testing, routine calibration, and spot checks; (3) to identify the equipment service requirements including identification of critical components; (4) to identify the current standards and guidelines that are required for recommended by government and non-government organizations for the review of the associated computerized treatment planning system; and (5) to perform analysis to determine the risk implications of the use of these devices.

5507 Microbiology

Refer also to citation(s) 17742, 17745, 18076, 19473, 19474, 19536, 19570, 19573, 19576

19825 (CONF-911202–67) **Quantitative ruthenium method for analysis of nitrogen ion-implanted titanium alloy (Ti-6Al-4V) and the effect on bacterial adherence.** Giammara, B.L. (Louisville Univ., KY (United States)); Birch, D.J.; Dobbins, J.; Williams, J.M. Oak Ridge National Lab., TN (United States); Louisville Univ., KY (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92010447. Source: OSTI; NTIS; GPO Dep.

The effects of nitrogen ion implementation of Ti-6Al-4V alloy on growth of Pseudomonas aeruginosa bacteria on surfaces of the alloy have been investigated. Results for ion implanted samples were compared with controls with similarly smoothly polished surfaces and with controls that had intentionally roughened surfaces. The test consisted of exposing sterile alloy samples to a microbiological broth, to which 24-hour-old cultures of Pseudomonas aeruginosa had been added. After bioassociation at normal temperature 37°C, bacteria adhering to the surface were fixed and treated with a new ruthenium tetroxide staining method, and quantified by use of scanning electron microscopy (SEM), back-scattered electron imaging and EDAX energy dispersive microanalysis. For smooth samples of the alloy, after a 12 hour growth period, the retained bacteria (revealed by the biologically incorporated ruthenium), decreased monotonically with nitrogen dose out to a total fluence of approximately $7 \times 10^{17}/cm^2$ in an affected depth of approximately 0.1500 μm. The SEM confirmed that the Pseudomonas aeruginosa adhered equally to control materials. The ruthenium studies revealed that the amount of bacterial adhesion is indirectly proportional to the nitrogen ion implantation of the titanium. The greater the percentage of nitrogen ion implantation in the titanium alloy, the less bacteria colonized the disk.

5508 Morphology

19826 (NEI-DK–770) **Effects of gaseous air pollutants on the Danish plant community.** Energiministeriets Energiforskningsprogram. Miljoe og restprodukter. Johnsen, I. (Institut for Oekologisk Botanik, Koebenhavns Universitet (DK)); Ro-Poulsen, H.; Soechting, U.; Mortensen, L. Copenhagen Univ. (Denmark). Inst. for Oekologisk Botanik; Copenhagen Univ. (Denmark). Inst. for Sporeplanter; Danmarks Miljoeundersoegelser, Roskilde (Denmark). Afd. for Forureningskilder af Luftforurening. Dec 1991 31p. (In Danish). Contract EM-1323/86-20. Order Number DE92506314. Source: OSTI; NTIS (US Sales Only).

EFP-86.

The purpose of the project was to investigate the importance, for Danish non-agricultural vegetation, of the gaseous air pollutants: Ozone, Sulphur Dioxide and Nitrogen Dioxide. Investigations were based on experiments in open-top chambers, where the climatic conditions are very close to those in the ambient surroundings. The air in the chambers were charcoal filtered, ambient, or added extra amounts of one er more of the three gasses to simulate elevated levels of the occurring variation. In the chamber bottoms the following plants were grown individually: Cladonia portentosa, Lotus corniculatus, Medicago lupulina, Empetrum nigrum, Calluna vulgaris, and finally, Fagus sylvatica, and Pices abies. Reindeer moss did not take up substantial amounts of nitrogen from the air. Fumigation with sulphur dioxide and nitrogen dixode, seems to cause washout of ions from the thallus. Ozone effects was observed, for the first time, on natural Danish herbs and shrubs. Large interspecific sensitivity variation was seen. For M. lupulina and C. vulgaris, the above-ground biomass increment was reduced by 40% and 25%, respectively, by a constant daytime additon of approximately 40 ppb ozone to the ambient concentrations. Neither L. corniculatus or E. nigrum seemed to be affected. P. abies was affected by the same ozone level, which caused disturbances to the growth of shoots and needles. Bud burst and shoot elongation was delayed, and a persistent reduction of needle length was found during two years experiments. F. sylvatica seemed to be very ozone sensitive, showing a marked reduced diameter increment and early senescense. (AB) 31 refs.

5510 Physiological Systems

Refer also to citation(s) 17822, 19937

5530 Agriculture and Food Technology

Refer also to citation(s) 18747, 19456, 19464, 19574, 19876, 19937

19827 (AECL–10048) **A review of the chemical aspects of irradiated shrimp.** Shamsuzzaman, K. Atomic Energy of Canada

Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Sep 1989. 49p. Order Number DE92626158. Source: OSTI; NTIS (US Sales Only); INIS.

The literature was reviewed for information on the chemical aspects of irradiated shrimp. Low-dose irradiation can effectively control spoilage and pathogenic organisms and extend the refrigerated shelf life of shrimp. Radiation-induced increases in black discoloration occur in some species during storage, but can be minimized by proper blanching. Some loss of the characteristic pink color occurs at doses above 2.5 kGy, and irradiation off-odors occur above 1.5 kGy. These changes can be minimized by irradiating the shrimp when they are frozen. No significant change in protein, fat, carbohydrate, and ash content occurs as a result of low-dose irradiation. Low-dose irradiation does not produce any detectable change in the levels of volatile carbonyl compounds; irradiation at 8 kGy results in a transient increase in the total volatile compounds during subsequent storage in ice, but the increase is higher in the unirradiated shrimp. Radiation-induced changes in the fatty acid composition of shrimp are small. Some minor changes in the amino acid composition occur in irradiated shrimp; similar changes occur due to other processes such as canning and drying in hot air. Some vitamins in shrimp such as thiamine are affected by irradiation. But the loss is less extensive than in thermally processed shrimp. The protein efficiency ratio is not affected by irradiation of shrimp, and no adverse effects attributed to irradiation were found in animal feeding studies.

19828 (AECL–10398) **Surface decontamination of cheddar cheese by electron-beam irradiation.** Shamsuzzaman, K. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment); Blank, G. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. 1991. 19p. Order Number DE92626159. Source: OSTI; NTIS (US Sales Only); INIS.

Cheddar cheese samples inoculated with two different levels of Penicillium cyclopium or Aspergillus ochraceus spores were vacuum-packed and irradiated at various doses up to 3.5 kGy with electrons from a 10-MeV linear accelerator. Unirradiated cheese showed visible mold growth in 8-25 d at 10 degrees C, and 7-12 d at 15 degrees C, depending on species and spore concentration. Only marginal extension of shelf life at 15 degrees C was achieved with cheese inoculated with 10^2 cfu per sample of either of the mold spores, followed by irradiation at 0.21 or 0.52 kGy. However, at these doses the average shelf life at 10 degrees C was extended by 41.5 and 50.5 d respectively when the inoculum was A. ochraceus. When the inoculum level was increased tenfold, irradiation at 1.2 and 3.5 kGy extended the average shelf life of cheese containing P. cyclopium by 44.5 and >262 d respectively at 10 degrees C, and by 3 and >166 d respectively at 15 degrees C. The shelf life of samples containing A. ochraceus and irradiated at 1.2 or 3.5 kGy was extended by at least 255.5 d at 10 degrees C and at least 160 d at 15 degrees C. The results clearly showed that low radiation doses are effective in the mold decontamination of cheese. The results also suggest that P. cyclopium in Cheddar cheese is more radiation-resistant than A. ochraceus. This was supported by determination of radiation survival curves for the two species incorporated into Cheddar cheese: D_{10} values for P. cyclopium and A. ochraceus were found to be 0.40 and 0.21 kGy respectively. The radiation sensitivity of the two organisms was found not to vary with pH in the pH range 5.0-6.2.

19829 (ANL/ESD/TM–25) **Minimal Technologies Application Project: Planning and Installation.** Zellmer, S.D.; Hinchman, R.R.; Severinghaus, W.D.; Johnson, D.O.; Brent, J.J. Argonne National Lab., IL (United States). Energy Systems Div. Mar 1989. 59p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012103. Source: OSTI; NTIS; GPO Dep.

Intensive and continuous tactical training during the last 35 years at the Hohenfels Training Area in West Germany has caused the loss of vegetative ground cover and has accelerated soil erosion rates, resulting in extensive environmental damage, safety hazards, and unrealistic training habitats. The objectives of this project are to develop and evaluate revegetation procedures for establishing adequate vegetative cover to control erosion at minimal costs and disruption to training activities. This project involved the development and installation of 12 revegetation procedures that combined four seedbed preparation methods and seeding options with three site-closure periods. In March 1987, the four seedbed preparation/seeding options and closure periods were selected, a study site design and location chosen, and specifications for the revegetation procedures developed. A German rehabilitation contractor attempted the specified seedbed preparation and seeding on the 13.5-ha site in June, but abnormally high rainfall, usually wet site conditions, and lack of adequate equipment prevented the contractor from completing six of the 12 planned procedures. Planning and execution of the project has nonetheless provided valuable information on the importance and use of soil analytical results, seed availability and cost data, contractor equipment requirements, and time required for planning future revegetation efforts. Continued monitoring of vegetative ground cover at the site for the next two years, combined with cost information, will provide necessary data to determine which of the six revegetation procedures is the most effective. These data will be used in planning future rehabilitation efforts on tactical training areas.

19830 (IAEA-R–6580-F, pp. 42-51) **Laboratory investigations of insecticide impregnated materials for the control of New World screwworm flies.** Harris, E.G. (Natural Resources Inst., Chatham (United Kingdom)); Brown, M.; Smith, S. Natural Resources Inst., Chatham (United Kingdom); Tsetse Research Lab., Bristol (United Kingdom); Natural History Museum, London (United Kingdom); Al-Fateh Univ., Tripoli (Lybia); International Atomic Energy Agency, Vienna (Austria). Feb 1992. Sponsored by International Atomic Energy Agency, Vienna (Austria). In *Development of an odour-baited insecticidal target system for the suppression of adults of the new world screwworm fly: Final report for the period 15 April 1991 - 31 January 1992.* 77p. Order Number DE92626112. Source: OSTI; NTIS (US Sales Only); INIS.

In laboratory tests, New World screwworm flies were found to be at least three orders of magnitude less susceptible to the insecticides deltamethrin, alphacypermethrin and cyfluthrin than are tsetse flies. Deltamethrin was the most toxic of the three insecticides to screwworm flies. For topical application, the LD50s for deltamethrin 20% suspension concentrate were 33 ng and 25 ng for male and female screwworm flies respectively, compared with 0.04 ng for tsetse, G.m. morsitans. In various tests simulating contact of screwworm flies with cloth or netting targets impregnated with insecticide, 100% kill was only achieved with 3.2% deltamethrin and contact times of at least 10 sec, although 100% knockdown for up to 24 hours was obtained with lower concentrations. No repellent effect was observed at the higher concentrations. Cloth targets impregnated with a high dose of insecticide and baited with an attractant could be effective against NWS flies, especially if after "knockdown" flies are removed by predators. 1 fig., 9 tabs.

19831 (IAEA-TECDOC–634, pp. 21-24) **The development and application of antigen-detection enzyme immunoassays (antigen-ELISA) for diagnosis and control of African trypanosomiasis.** Nantulya, V.M. (International Laboratory for Research on Animal Diseases, Nairobi (Kenya)); Lindqvist, K.J.; Masake, R.A. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Antigen-trapping enzyme immunoassays (Ag-ELISA) for the detection of circulating trypanosome antigens in the blood of infected animals were developed by ILRAD and the CTVM in response to a well-recognized need for improvement of the techniques for the diagnosis of African trypanosomiasis. With the conventionally used parasitological diagnostic methods, detection of the parasites is often curtailed by the fact that in the chronic phase of the disease, parasitaemia is intermittent and often not detectable. The antigen-trapping ELISA systems which were developed have already shown encouraging results; the assay systems detect circulating trypanosome antigens, therefore patent infections. Applied to the diagnosis of bovine trypanosomiasis, a sensitivity of 96% was observed at ILRAD, and with good specificity. The assays are easy to perform, the results can be read visually if necessary and large numbers of sera can be analysed at a time. A number of practical problems, such as transportability of biological reagents, the water quality required for the assay and the future assay quality assurance system are currently being addressed in the Network. Once these problems have been solved, the assays should be employed as a sensitive diagnostic tool in national tsetse and trypanosomiasis control programmes to determine the effectiveness of these programmes and to assess the efficacy and strategic use of trypanocidal drugs. (author). 13 refs.

19832 (IAEA-TECDOC–634, pp. 25-30) **Application of antigen-ELISA for the diagnosis of surra in selected camel herds in Kenya.** Olaho-Mukani, W. (Kenya Trypanosomiasis Research Inst., Nairobi (Kenya)); Munyua, W.K.; Omuse, J.K.; Njogu, A.R.; Mutugi, M.W. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Kenya has about one million dromedary camels. These are kept in the arid and semi-arid areas of the eastern and north-eastern provinces of the country. The dromedary camel plays an important role in the livelihood of the nomadic pastoral tribes of Kenya, where they are mainly used for milk, meat and as draft animals. Of the diseases affecting camels in Kenya, trypanosomiasis due to Trypanosoma evansi is the most important. The disease causes mortality of up to 70%, abortions and wight losses in affected herds. Measures aimed at controlling the disease have always been hampered by the lack of sensitive diagnostic tests. In recent years, the application of enzyme immunoassays has greatly improved the diagnosis of trypanosomiasis. In an antigen-ELISA test which employs a monoclonal antibody, we were able to detect more than 90% of patent infection in affected camels. The test is sensitive, specific and easy to perform. The test is very promising in the diagnosis of patent and cryptic trypanosome infection. The significance of the results is discussed. (author). 10 refs, 4 figs, 2 tabs.

19833 (IAEA-TECDOC–634, pp. 31) **Validation of the ELISA technique for diagnosis of trypanosomiasis in cattle in Uganda.** Okuna, N.M. (Uganda Trypanosomiasis Research Organization, Tororo (Uganda)). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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ELISA, developed in ILRAD for diagnosis of T. congolense, T. brucei and T. vivax in cattle, has not been validated in Uganda. This study was undertaken to validate the technique. Negative reference sera were collected from 44 cattle in Kapchorwa, a tsetse-free area. The cattle were free of the three trypanosome species T. congolense, T. brucei and T. vivax by the haematocrit buffy coat technique (BCT). But by ELISA, three were positive for T. vivax, one for both T. congolense and T. vivax and one for T. congolense. Sera were collected from the same 44 cattle 10 weeks later. The cattle were again free of T. congolense, T. brucei and T. vivax, both by BCT and by mouse inoculations. Two cattle out of 450 screened at a centre 5 km away had T. vivax by BCT. The ELISA results for the second set of sera were quite similar to the results obtained from the first set of sera. The calculated optical density (D) cut off point was 50 for both T. brucei and T. vivax, but it was 60 for T. congolense. Sera from 5 cattle which had T. theileri and two which had microfilaria were all negative for antigenaemia by ELISA. Positive reference sera were collected form 40 cattle in a high tsetse challenge area. Using the haematocrit buffy coat technique, 5 had T. vivax, two had T. brucei and one had T. congolense. Checked by ELISA for antigenaemia, only 4 cattle were free of all the three trypanosome species, T. congolense, T. vivax and T. brucei. All the 40 cattle were treated with Diminazene aceturate at the rate of 7 mg/kg body weight. Two weeks later, the ELISA test showed that 10 cattle were free of any antigenaemia. Those still positive for antigenaemia had lower OD readings. The ELISA technique is valid. It is much more sensitive compared to parasitological tests. It is specific since none of the 7 cattle with either T. theileri or microfilaria gave positive results by ELISA. The technique would be very useful for epizootiological studies. (author).

19834 (IAEA-TECDOC–634, pp. 37) **Investigations of intramuscularly induced diminazene aceturate (Berenil^{R}) plasma levels in cattle under high tsetse and trypanosome challenge in the field.** Kratzer, R.D. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Ismail, A.; Omukuba, J.; Murilla, G.; Loehr, K.F.; Maloo, S.; Muenstermann, S. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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The prophylactic effect of trypanocides is significantly reduced under high fly and trypanosome challenge. It was assumed that this is due to a reduction of drug plasma levels by trypanosomes at the time of treatment and challenge. Cattle herded at the Kenya coast under high fly and trypanosome challenge and cattle herded at KETRI without fly and trypanosome challenge were treated repeatedly with Berenil^{R} and the plasma levels established using the HPLC technique. Comparing both groups of cattle, it was found that neither the height of the initial peak nor the half lives of the plasma levels were significantly different. (author).

19835 (IAEA-TECDOC–634, pp. 39) **A comparison of intramuscularly induced plasma levels of diminazene aceturate (Berenil^{R}), homidium bromide (Ethidium^{R}) and isometamidium chloride (Samorin^{R}) in infected and uninfected cattle.** Kratzer, R.D. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Turkson, P.K.; Ismail, A.; Omukuba, J.; Cagnolati, V. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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The prophylactic effect of trypanocides is significantly reduced under high fly and trypanosome challenge. It was assumed that this might be due to a reduction of drug plasma levels by trypanosome parasitaemia. The ^{14}C labelled trypanocidal drugs Berenil^{R}, Ethidium^{R} and Samorin^{R} were administered intramuscularly in uninfected and in cattle infected with Trypanosoma congolense. The radioactivity levels were determined in plasma. The results indicated a slight but non-significant reduction in initial plasma level in infected cattle. Therefore, it can be concluded that the amount of drug trypanosomes are taking up is not influencing the plasma level and therefore is not lowering the curative or prophylactic effect. (author).

19836 (IAEA-TECDOC–634, pp. 41) **Sorbent extraction and high performance liquid chromatography (HPLC) of homidium bromide and isometamidium chloride in bovine plasma.** Kratzer, R.D. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Karanja, W.M.; Murilla, G. International Atomic Energy

Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Homidium bromide and isometamidium chloride are used extensively in the treatment of bovine trypanosomiasis in Africa, but no specific and sensitive method to detect the drug in plasma has been published yet. Comparing the methods of other investigators it was found that they could not overcome the protein binding of these drugs which reduced the available and determined drug to 10% of the real concentrations. These techniques overcome the protein binding by enzyme digestion and an alteration of the pH before adding the sample directly on clean-up columns. Drug recover rates above 80% were obtained. For the detection, the HPLC was employed using a C18 reversed phase analytical column and UV detection, determining both drugs as intact molecules. (author).

19837 (IAEA-TECDOC–634, pp. 53-57) **Metabolite studies of isometamidium in cattle.** Mdachi, R.E. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Murilla, G.A.; Kratzer, R.D. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Isometamidium, a phenathridinium compound, has been used extensively both for prophylaxis and therapy against trypanosomiasis in cattle. The lack of detection of this drug in serum and urine within 24 hours following either i.v. or i.m. administration of the non-labelled drug as opposed to the labelled drug, would suggest either insensitivity of the methods used or rapid metabolism of the drug to compounds which are active against trypanosomes at these concentrations. A preliminary study was carried out using liver, kidney, bile, blood and urine samples from two groups of steers, one of which had been treated with ^{14}C-isometamidium labelled on the homidium molecule and the other with ^{14}C-isometamidium labelled on the benzamidine molecule and slaughtered 21 and 60 days after treatment. Isometamidium was detected in the liver up to 21 days post treatment but was not detected at 47 and 60 days post treatment. Metabolites which corresponded to homidium and benzamidine derivatives were detected in liver, kidney, bile and urine samples. No isometamidium was detected in urine collected 24 hrs after treatment. From this study, it seems that the prohylactic activity of isometamidium is due to homidium and/or its derivatives. (author). 8 refs, 3 tabs.

19838 (IAEA-TECDOC–634, pp. 45-51) **Solid phase extraction and reversed-phase high performance liquid chromatography of homidium in animal tissues.** Murilla, G.A. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Mdachi, R.E.; Kratzer, R.D.; Karanja, W.M. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Homidium bromide, an antitrypanosomal drug, has been in use for about 40 years both for chemotherapy and limited chemoprophylaxis but no specific and accurate method for its detection at sub-microgram levels in tissues is available. The HPLC method described uses C18 reversed phase analytical column with UV detection after basic sample extraction and clean-up on a 3 ml cyano Bond Elut disposable extraction column. Drug recoveries of up to 80% were obtained in the extracts. All tissues analysed were from animals treated with ^{14}C labelled homidium at a dose of 1 mg/kg body weight and slaughtered at 14, 21 and 28 days after treatment. Recoveries were determined by comparing radiometric and HPLC results. The advantage of this procedure was that large amounts of samples could be processed especially from tissues with low drug levels. The detection limit was 50 ng per gram wet tissue. This method is simple, fast, accurate and sufficiently sensitive to be used for monitoring drug levels in meat destined for human consumption. (author). 3 refs, 4 figs, 6 tabs.

19839 (IAEA-TECDOC–634, pp. 65-89) **Fat and Haematin contents of male tsetse flies Glossina pallidipes and G. m. morsitans (Diptera: Glossinidae) caught in odour-baited traps and artificial refuges in Zimbabwe.** Hargrove, J.W. (Bristol Univ., Bristol (United Kingdom). Tsetse Research Lab.); Packer, M.J. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Male G. m. morsitans and G. pallidipes caught in artificial refuges had 27 - 31% more fat than those caught in traps; mean haematin levels were 6.8 - 7.7 times higher, but haematin-specific fat levels did not differ between capture methods. Male G. pallidipes with haematin level >150 ug, which had fed <8 h previously, contained 3.2 mg fat - only 15% less than the highest observed levels. A differential equation model for bloodmeal metabolism is developed; it removes 99% of the variance in fat levels of male G. m. morsitans fed and then starved in the laboratory and 79% of this variance for the G. pallidipes field data. The model predicts a mean feeding interval (T) of 53 h and fat levels of 3.1 mg in newly fed flies - close to the observed value of 3.2 mg for flies containing more than 150 ug haematin. Haematin frequency data, analysed as suggested in the literature, suggested T = 71 h, with a 60 h non-feeding phase, but fat levels predicted by simulation were 40% lower than observed. For constant feeding rates, fat levels were well simulated for T = 53 h, but death rates (>5%/day due to starvation alone) were impossibly high. An alternative model, based on known changes in activities related to feeding, suggests that feeding rates increase linearly during the trophic cycle. For T = 53 h the model gives good predictions of fat levels in G. pallidipes, with starvation rates <1%/day; it is suggested that a proportion of tsetse with high fat and haematin feed off mobile hosts early in the trophic cycle. Over-estimates of T result from the failure to consider these flies and not to errors in the assumed time scale, nor failure to catch high-fat flies which visit stationary traps. (author). 32 refs, 16 figs, 2 tabs.

19840 (IAEA-TECDOC–634, pp. 91-103) **Study of the vectorial capacity of Glossina palpalis palpalis related to its digestive physiology and rearing conditions.** Abbeele, J. van den (Antwerp State Univ., Antwerp (Belgium). Lab. of Biochemistry and General Zoology); Decleir, W. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

The tsetse midgut environment constitutes the early barrier in the development of the parasite in his insect host. Factors such as trypanolysins, midgut lectins and agglutinis have been shown by various authors to influence the establishment of a procyclic trypanosome population. So far, the digestive process has not been considered as a possible factor affecting the survival and differentiation of ingested trypanosomes. This paper deals with our investigations on the digestive physiology of Glossina palpalis palpalis. The course of the digestive cycle, the purification and partical characterization of midgut trypsin, the major proteolytic enzyme, are described. The possible interaction of the digestive activity and trypanosome development is discussed. (author). 20 refs, 8 figs, 3 tabs.

19841 (IAEA-TECDOC--634, pp. 105-117) **Biosynthesis of lipids in female tsetse flies following matings with radiation-sterilized or normal males.** Lambremont, E.N. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories); Taher, M. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Tsetse females mated to radiation-sterilized males have a pattern of lipid synthesis identical to those mated normally through nearly all levels of lipid content except one. Synthesis of lipids from injected (^{14}C)-1,2-acetate shows no mating condition correlation for total lipids, total phospholipids, total neutral lipids or for major sub-classes of phospholipids or most neutral lipids. Only the 1,2-diacylglycerols show a distinct depression of synthesis and then only in the uterine gland of a female mated to an irradiated male. Thus without carrying lipid analyses to a level distinguishing isomeric forms in a specific type of tissue, one could not discern an ultimate difference in the lipid biochemistry of the abnormally mated female. (author). 13 refs, 6 tabs.

19842 (IAEA-TECDOC--634, pp. 119-121) **Comparative study on the susceptibility of different Glossina species to trypanosoma vivax, T. congolense or T. b. brucei.** Moloo, S.K. (International Lab. for Research on Animal Diseases, Nairobi (Kenya)). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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The present study was undertaken to determine if there were differences in the innate susceptibility of seven different laboratory-bred Glossina species and subspecies belonging to the three main taxonomic groups, morsitans, palpalis and fusca, originating from different parts of Africa, to Trypanosoma vivax isolated in Kenya and Nigeria. to T. congolense isolated in Tanzania and Nigeria, and to T. b. brucei isolated in Tanzania and Nigeria. 4 tabs.

19843 (IAEA-TECDOC--634, pp. 123-125) **Vectorial capacity of Glossina palpalis gambiensis after combined radiation and low temperature treatment during the late pupal stage.** Djiteye, A. (Laboratoire Central Veterinaire, Bamako (Mali)); Bauer, B.; Vloedt, A. van der; Feldmann, U.; Vreysen, M.J.B. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Glossina palpalis gambiensis is one of the four tsetse fly species together with G. tachinoides, G. m. submorsitans and countries of West Africa, it is an important vector of trypanosomiasis. The species is being maintained for a long time at the CRTA rearing centre, and is one of the three species for which the SIT was successfully used in the Sideradougou eradication campaign. Plans are in preparation to use flies from CRTA to mount an integrated control campaign with SIT component in the Tienfala-Baguineda agro-pastoral zone of Mali. Therefore, after preparatory work at the FAO/IAEA Seibersdorf Laboratory, series of fly infectivity studies were conducted at CRTA, using materials from the local stock colony and available trypanosome stabilates: Trypanosoma vivax (Zaria 81/486/699 and Banan 85/CRTA/78), T. congolense (Karankasso 83/CRAT/57) and T. b. brucei (Farakoba 80/CRTA/1). 1 tab.

19844 (IAEA-TECDOC--634, pp. 129-140) **Study of tsetse-host immunity relationships with respect to mass rearing and tsetse eradication.** Soldan, T. (Czechoslovak Academy of Sciences, Ceske Budejovice (Czechoslovakia). Entomology Inst.); Matha, V.; Weyda, F.; Kopacek, P.; Volf, P. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of repeated exposition of alternative hosts (rabbits, mice) to flies was characterized by two different types of adaptive response mechanisms: the induction of serum "killing factor", and the induction of high titre of circulating IgG cross-reacting with relatively wide spectrum of tsetse (glyco) proteins isolated either from various tissues, or whole body homogenates. The question remains how these pathways are involved in host-vector interaction under natural conditions. "Killing factor"seems to be responsible for dramatic increase of fly mortality following sucking. It is passively transferable but its effect disappears during about 5 days following sucking or passive immunization. On the contrary, the immunoglobulins persist in host blood for at least 70 days but they are probably not responsible for direct killing of biting flies. However, their role in fly longevity, reproduction, and vector-parasite interaction was determined. (author). 18 refs, 7 figs, 1 tab.

19845 (IAEA-TECDOC--634, pp. 143-150) **The durability of pyriproxyfen, a juvenile hormone mimic, for insect control.** Langley, P.A. (Bristol Univ., Bristol (United Kingdom). Tsetse Research Lab.); Mauchamp, B.; Royer, C.; Oouchi, H. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Topical applications of the juvenile hormone mimic, pyriproxyfen, to adult females of the tsetse fly, Glossina morsitans morsitans, result in the production of offspring which fail to metamorphose. Similar applications to adult females of the triatomine bug Rhodnius prolixus, results in the production of non-viable eggs, while treatment of fifth instar larvae prevents metamorphosis or gives rise to adults which produce non-viable eggs. Exposure by tarsal contact to netting surfaces treated with an oil formulation of radiolabelled puriproxyfen, resulted in adult females of Glossina m. morsitans producing non-viable pupae for life. Netting stored under laboratory conditions showed no sign of loss or degradation of pyriproxyfen for 8 months. Similar netting exposed to natural conditions in the field in Zimbabwe has similarly shown no signs of degradation or of loss of the original amount of pyriproxyfen with which it was treated. The prospects of using pyriproxyfen as a safe substitute for conventional insecticides are promising. (author). 10 refs, 3 tabs.

19846 (IAEA-TECDOC--634, pp. 151-165) **Genetic studies on Glossina morsitans and Glossina palpalis related to genetic control.** Gooding, R.H. (Alberta Univ., Edmonton, AB (Canada). Entomology Dept.). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15

Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Non-assortative mating of closely related taxa and their low reproductive capacity makes tsetse likely targets for population suppression by use of sterile hybrids or satyrs. Evaluation of the potential for such control methods will be facilitated by a knowledge of the genetics of tsetse flies. At the University of Alberta, such studies are carried out on the following subspecies of tsetse: G. m. morsitans, G. m. centralis, G. m. submorsitans, G. p. palpalis, and G. p. gambiensis. Most of the genetic variants are detected by electrophoretic procedures, but five visible markers (ocra, salmon and sabr in G. m. morsitans; tan and brick in G. p. palpalis) are also maintained. Fourteen marker genes have been mapped in G. m. morsitans, four in G. m. submorsitans and two in G. p. palpalis. Other biochemical markers have been assigned to autosomes or the X chromosome and inbred lines are being established for mapping four X chromosome genes and four autosomal genes in G. p. palpalis. These marker genes are being used in studies of the genetic basis of hybrid male sterility, potential for introgressive hybridization, sperm use by double-mated females, genetic stability of tsetse colonies, and genetics of mating behaviour. Using genetically marked lines it has been established that an X -Y incompatibility is a major factor in the sterility of males produced by hybridizing G. m. morsitans and G. m. centralis, G. m. submorsitans and G. m. morsitans, and G. p. palpalis and G. p. gambiensis. In subspecies of morsitans, there are also maternally inherited factors that create asymmetries in the ability of flies to hybridize. Using genetically marked flies, it has been established that some twice-mated females use sperm from both matings. However sperm use is, in some cases, influenced by whether the male is from the same subspecies as the female and this suggests a severe limitation on the use of satyrs as genetic control agents. (author). 46 refs, 6 tabs.

19847 (IAEA-TECDOC-634, pp. 167-180) **Tsetse fly mass rearing: Colony management, deployment of sterile flies, related research and development.** Feldmann, U. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories); Luger, D.; Barnor, H.; Dengwat, L.; Ajagbonna, B.; Vreysen, M.J.B.; Vloedt, A. van der. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

In support of tsetse fly research and control programmes in Africa, seven economically important tsetse fly species (Glossina palpalis palpalis, G. tachinoides, G. fuscipes fuscipes, G. austeni, G. brevipalpis, G. pallidipes and G. morsitans submorsitans) are maintained at the Entomology Unit of the IAEA Agriculture Laboratory at Seibersdorf, Austria. All flies are reared without host animals and are fed exclusively by the membrane feeding technique. The strains of the first five species above are adapted to mass-rearing procedures and are maintained in numbers sufficient to meet the needs for field releases and for laboratory experiments. The colony of G. tachinoides is maintained at 100,000 females to demonstrate (i) the time required for transition of an adapted strain to a mass-reared colony, (ii) the ability to routinely ship pupae (35,000 every three weeks) a long distance and (iii) the high quality of sterile males originating from transported pupae. Topics requiring R and D for large scale use of SIT to combat tsetse flies include simplification and automation of the laborious day-to-day colony routine work. Emphasis is placed on procedures that offer potential for sex differentiation in pre-adult stages or that offer a better synchronization of adult emergence with minimal overlapping of the sexes. Development of methods for extending the duration of the pupal period would increase flexibility in preparing for long distance transport of pupae to release projects. For all tsetse fly species colonized at Seibersdorf, radiation dose-response data are collected and the quality of the treated fly material evaluated. The receptivity of irradiated virgin females to mating is studied, in view of using them as indicator or sentinel insects for detection and monitoring of native male populations existing at low density or being subjected to control measures. (author). 8 refs, 11 figs, 5 tabs.

19848 (IAEA-TECDOC-634, pp. 183-190) **A study of factors affecting the persistence of deltamethrin applied to cotton fabric for tsetse fly control.** Hussain, M. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories); Perschke, H. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of selected lipohilic materials on the loss of deltamethrin applied to cotton fabric and washed with water was studied. Corn oil, paraffin, linseed oil and silicone oil reduced the leaching of deltamethrin by water from the fabric. The cumulative sum of four washings of the treated cotton strips resulted in a total loss of 37.7% of deltamethrin from the cotton strip (without protectant) and 9.9% from the strip treated with deltamethrin and corn oil. The effect of the colour of fabric and a UV absorber compound on the photodegradation of deltamethrin were also studied. Photodegradation was much less on the blue or black fabric than on the white fabric, and 2, 4-dihydroxy-benzophenone reduced the photodegradation of deltamethrin applied to cotton fabric. (author). 10 refs, 4 figs, 1 tab.

19849 (IAEA-TECDOC-634, pp. 191-192) **Experienced with odour baited insecticide impregnated targets for control of tsetse flies in Kenya.** Opiyo, E.A. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Omuse, J.K. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Tsetse control in Kenya has hitherto been by use of insecticide sprayed from the ground supplemented by limited bush clearing in areas where human trypanosomiasis occurs. Animal trypanosomiasis is controlled by chemotherapy. Due to the occurrence of resistant trypanosome strains on Galana Ranch and in the coastal strip and the demonstration in Zimbabwe that odour-baited deltamethrin-impregnated targets were highly effective control devices against morsitans group tsetse flies. KETRI undertook to test the effectiveness of targets in the Kenya situation on the Galana Ranch. This was in an effort to find an additional trypanosomiasis control strategy. This trial began in January 1986 and lasted three years. The success of the trail resulted in a similar trial being undertaken in the Lambwe Valley. The Lambwe trial began in July 1988 and the objectives were (i) to evaluate the effectiveness and sustainability of deltamethrin impregnated odour baited targets and (ii) to involve the community in installation and maintenance of targets for their own protection. (author).

19850 (IAEA-TECDOC-634, pp. 193) **Field testing of improved insecticide formulation for control of tsetse using baited targets.** Opiyo, E.A. (Kenya Trypanosomiasis Research Inst., Kikuyu (Kenya)); Omuse, J.K.; Hussain, M.; Kiragu, J. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Field testing of insecticide impregnated blue strips for persistence began in Lambwe Valley in the middle of October 1990. Samples from the strips are cut every 20 days and are subjected to bioassays using teneral G. morsitans while samples are sent to Seibersdorf, Austria, for chemical analysis. The daily temperature and rainfall figures are kept for the period of the trial. To date, three samples, including the day 0 sample have been tested using teneral tsetse flies. All tsetse flies that came into contact with the samples of treated strips cut on days 0,20 and 40 died, but after varying intervals. Observations are continuing. (author).

19851 (IAEA-TECDOC--634, pp. 195) **Development of controlled release formulations of pesticides using nuclear techniques for the control of tsetse flies.** Matechi, H.T. (Tropical Pesticides Research Inst., Arusha (United Republic of Tanzania)); Maeda, D.N.; Macha, P.S.M.; Mbise, S.R.; Sikay, M. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Experiments were conducted on the use of controlled-release (CR) formulations of pesticides using nuclear techniques for the control of tsetse flies (Glossina spp.). Strips of cotton fabric screens impregnated with Carbon-14-labelled deltamethrin formulations, some of which contained oils, UV light absorber or both were tested. Then the strips were hung under tsetse habitats and tests were repeated at intervals of 2-3 weeks for about 6 months. Tests were of two types: Bioassay tests against tsetse flies to determine which formulations had the longest residual toxicity and radioanalytical test for determining radioactivity left on the strips and how it correlated with bioassay tests. Results show that total radioactivity and mortality decreased with time being rapid on unprotected strips or that containing oil. The strip containing UV light absorber or Glossinex had high losses of activity but continued to attain high mortalities up to day 175. Strip containing both oil and UV light absorber had the best performance. Until day 175 it recorded 85% mortality and radioactivity loss of 41% while the rest of the strips had lost more than 75%. (author).

19852 (IAEA-TECDOC--634, pp. 197-204) **Simple creation of controlled release formulations of insecticides by a polymeric spray tank additive.** Allan, G.G. (Washington Univ., Seattle, WA (United States). Dept. of Chemical Engineering); Allan, R.G.; Carroll, J.P.; Neogi, A.N. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

The seven main mechanisms whereby sprayed insecticides are rendered biologically inactive are identified. The beneficial diminution of these destructive effects by dissolution of the pesticide in a polymeric matrix is discussed. The problems of the controlled release delivery system so created and insecticide availability therefrom are analyzed in terms of the decreasing concentration of pesticide therein with the passage of time. The theory of a proposed method to circumvent the controlling laws of diffusion by dissolving the polymer in the insecticide, rather than vice versa, is explained and the idea of the addition of a bioinactive co-leaving component is introduced. The practicality of this new concept is demonstrated by the creation of a simple spray tank additive which forms a constant rate, polymeric, controlled release delivery system on the substrate sprayed. The functionality of the spray tank additive is exemplified by combination with three insecticides, methyl parathion, disulfoton and the toxin from Bacillus thuringiensis, and comparative biological testing. (author). 12 refs, 3 tabs.

19853 (IAEA-TECDOC--634, pp. 205) **Tsetse and trypanosomiasis control in Zimbabwe.** Chadenga, V. (Department of Veterinary Services, Causeway (Zimbabwe). Tsetse and Trypanosomiasis Control Branch). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Trypanosomiasis, a disease transmitted by tsetse flies, is a major constraint on Agricultural Production in Tropical Africa. In Zimbabwe where agriculture, and particularly stock raising, is of major economic and social significance, the control of the tsetse fly leading to its eradication is a task of national importance. Zimbabwe has achieved significant progress in tsetse and trypanosomiasis control with a total of 48,000 km^2 being cleared of tsetse since 1980. The cleared areas have been consolidated by planned human settlement whose agricultural production has increased following introduction of cattle which provide much needed traction power. Tsetse flies are now confined to an area of 25,000 km^2 along the Zambezi Valley. Several strategies are being used to control tsetse flies with the latest technique being the use of odour-baited insecticide-impregnated targets. When used at a density of 4/km^2, targets have been found to be extremely effective against the species of tsetse flies found in Zimbabwe. The work undertaken in Zimbabwe as well as prospects for the future within the EEC-funded Regional Tsetse and Trypanosomiasis Control Programme will be discussed. (author).

19854 (IAEA-TECDOC--634, pp. 207) **Integrated tsetse management in Southwestern Ethiopia.** Tikubet, G. (Addis Ababa Univ., Addis Ababa (Ethiopia). Biology Dept.). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172--: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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A collaborative research programme has been conducted to develop a practical tsetse management model that combines cost effective tsetse control method, strategic use of drugs and environmentally sound land use planning. In this connection, special efforts have been made to validate and modify the already known tsetse control techniques. The NGU trap baited with acetone and cow urine showed significant increases (4.8-fold for male flies and 7.5-fold for female flies) over the unbaited bioconical trap. The biconical traps baited with cow urine, hippo dung and Octenol yielded highter catches (1.3 to 2.6-fold increase for male flies, 1.4 to 4.6-fold for females) than unbaited bioconical traps. Cow urine, however, was the only one of these attractants that showed a significant increase in most instances. Biconical traps baited with pig urine and acetone showed a significant 2.6-fold increase over unbaited biconical traps. A new trap design (Tetra-trap) is tested against biconical and NGU traps. Cow urine, acetone and a 4:8:1 mixture of octenol, methyl phenol and propyl phenol obtained from the Tropical Diseases Research Institute was tested using the new trap design.

19855 (IAEA-TECDOC--634, pp. 209) **Interim strategies to control animal trypanosomiasis in two selected villages along the white volta river in the onchocerciasis free zone of Northern Ghana.** Doku, C.K. (Ministry of Agriculture, Pong Tamale (Ghana). Tsetse and Trypanosomiasis Control Unit); Mahama, C.I. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan

1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991*. 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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The onchocerciasis eradication campaign in the west African subregion was a remarkable success which made formally deserted lands now suitable for settlement. Recent tsetse and trypanosomiasis surveys along the White Volta river indicate that livestock development would virtually be impossible in these areas without some form of intervention to contain animal trypanosomiasis. Apparent fly densities are in the order of 5-10 flies/trap/day (biconica traps) with fly infection rate being in the order of 1-8.0%. Trypanosomiasis is particularly prevalent in small ruminants (12-30%) with several reported cases of abortion. In view of the sparse human population in some of these areas, large scale control programmes would not be advisable unless there is a clear land-use plan. In the interim, however, efforts could be made to control the disease at the village level. This paper outlines some village-based strategies that could be adopted by settlers in these areas. (author).

19856 (IAEA-TECDOC–634, pp. 211) **Trypanosomiasis control and eradication of Glossina austeni from Zanzibar using an integrated approach.** Biwi, K.M. (Veterinary Office, Zanzibar (United Republic of Tanzania). Livestock Development Dept.). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991*. 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Eradication of G. austeni for the removal of the trypanosomiasis constraint from the island of Unguja, Zanzibar, appears feasible by using an integrated approach. The use of animals as living baits, treated with a 1% deltamethrin pour-on oil formulation, combined with drug treatment of animals found infected with trypanosomes was successful in grazing areas with a sufficient number of cattle. In areas where other tsetse hosts are present or where cattle are absent (like Jozani and Muyuni forests), stationary targets impregnated with Alfacypermethrin 10% E.C. were found effective in reducing fly populations. Such prior suppression is suitable before the release of sterile males. In order to enhance the future use of the SIT where cattle treatment or stationary targets alone may not result in tsetse eradication, pre-release studies on transportation and deployment of sterile flies produced at Tanga and released in a related block of the dense forest have commenced recently, as well as observations on the G. austeni populations structure. Results of work on the bait technology and investigative work using sterile flies are described in the papers of D. Hoereth-Boentgen and M. Vreysen et al. (author).

19857 (IAEA-TECDOC–634, pp. 213-218) **Control of Glossina austeni and cattle trypanosomiasis in Unjuga island by deltamethrin pour-on application to livestock and with stationary targets in cattle-free zones.** Hoereth-Boentgen, D.W. (FAO Animal Disease Control Project, Zanzibar (United Republic of Tanzania)). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991*. 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Tsetse control with odour-baited artificial targets has been widely used in recent years in countries like Zimbabwe, Zambia, Ethiopia, Ivory Coast and Burkina Faso among others. More recently, this method was expanded by the use of the host animal itself, as a "living target". The development of highly effective synthetic pyrethroids in long-lasting formulations, and particularly the low mammalian toxicity of these compounds, made such an approach possible. The first trials have been carried out in Zimbabwe, Zambia, Zanzibar and recently at Mkwaja Ranch in Tanzania. Results achieved with FAO assistance in a pilot-trial in the Mangapwani area on Zanzibar have been converted into a large-scale operation under the UNDP/FAO supported project URT/86/022, aiming at complete removal of G, austeni from the island of Unjuga. The present paper outlines the results achieved so far with the use of sequential, topical application of deltamethrin on cattle, goats and donkeys to eradicate G. austeni. An alternative approach for tsetse control in areas where cattle are virtually absent is also described. (author). 12 refs, 2 tabs.

19858 (IAEA-TECDOC–634, pp. 219-230) **Laboratory and field observations in relation to the release of sterile Glossina austeni on Unjuga (Zanzibar) island.** Vreysen, M.J.B. (Ministry of Agriculture, Zanzibar (United Republic Tanzania). Tsetse Control Unit); Khamis, I.; Mramba, F. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991*. 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

The radiation treatments give to male Glossina austeni before their deployment in the field had no detectable effect on viability, insemination potential or competitiveness. Excellent results were obtained for both treated and untreated control males at cage densities of up to 800 flies. A total of 22,563 male G. austeni were transported from TTRI, Tanga, to the Jozani forest, Unjuga island, under two different release schedules. On average, 91.6% of the males transported were actually released. Direct transport in the morning (average transport time was 2.5 ± 0.5 hours) proved to be superior (release rate of 94.7%) compared to a schedule in which flies were transported from Tanga to Zanzibar in the evening with the release being done the next morning (release rate of 85.8%). Pre-release studies in the northern Jozani forest, demonstrated the efficiency of the sticky panel as a monitoring device for the collection of baseline data on apparent densities and age structure of the G. austeni population. Sterile female G. austeni were also released in the middle of the experimental block to test their usefulness as tracer insects. Treated females recovered 5 or more days post-release, were all found to be inseminated by native males. (author). 10 refs, 1 fig., 10 tabs.

19859 (IAEA-TECDOC–634, pp. 231) **Tsetse, trypanosomiasis and cattle raising in southern Anambra state, Nigeria.** Ekejindu, G.O.C. (Anambra State Univ. of Technology, Awka (Nigeria)); Nnamani, U.C.; Ogamba, O.C. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172–: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991*. 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Observations on flourishing resident herds and trade cattle within the Awka Zone in northern fringes of the rain forest belt of Anambra State, Nigeria, prompted this current study on the status of trypanosomiasis and tsetse distribution in the zone. Parts of the greater Mamu forest reserve and seven other forest patches covering 800 km^2 were studied. Except for two small forests others were infested with Glossina palpalis palpalis. 84 flies were captured, out of which one had mature Trypanosoma vivax infection. 443 cattle were examined in two slaughterhouses for trypanosomes. Only four of them had parasites that were identified morphologically as T. vivax. Deforestation due to industrialisation and development of the hinterland could contribute to lowered intensity of infection in an area originally thought very hazardous for livestock keeping. (author).

19860 (IAEA-TECDOC-634, pp. 243-244) **Activities of the tsetse control unit, Botswana.** Phillemon-Motsu, T.K. (Ministry of Agriculture, Gaborone (Botswana). Tsetse Fly Control Div.). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Botswana is at the extreme southern extent of the African tsetse belt, and most of the country does not provide a suitable environment for the maintenance of breeding tsetse fly populations. The principal permanent habitat is the Okavango Delta and its associated northern river system. The Okavango Delta is a sparsely settled area of permanent swamp, seasonal floodplain and low-lying islands. Tsetse existed in the delta long before written history of the area came into existence. Much of this infestation died out during the great rinderpest pandemic at the turn of the century, which decimated the host animals. Following collapse of the fly population, people took advantage of the situation and occupied more hospitable parts of the delta. However, the fly population eventually expanded to meet the settlers and in the early 1940's a conflict of interest arose. The Department of Tsetse Fly Control was subsequently formed. 1 tab.

19861 (IAEA-TECDOC-634, pp. 245) **Animal trypanosomiasis control in Uganda.** Gamurorwa, E.G. (Ministry of Animal Industry and Fisheries, Kampala (Uganda). Dept. of Veterinary Services and Animal Industry). International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Uganda, with a population of about 17 million people, depends largely on the Agricultural Sector both for subsistence and export. Uganda livestock stands at 4 million cattle, 2.5 million goats, 0.7 million sheep and 0.5 million pigs. The life of these animals is being threatened by various tropical diseases. Animal trypanosomiasis is endemic in all the 34 districts of Uganda except the highland areas of the country. These are correspondingly areas of high tsetse fly infestation. For effective control of this disease, therefore, an integrated approach is adopted. The country has been divided into three zones of disease incidence, namely the high, medium and low risk zones. Each zone has a slightly different treatment regime with curative and prophylactic trypanocidals as short term control measures. The long term aim is to eradicate the tsetse fly, and therefore, the disease.

19862 (IAEA-TECDOC-634, pp. 247) **Tsetse and trypanosomiasis control for the rural development of Buvuma Island, Lake Victoria, Uganda.** Ogwal, L.M. (Makerere Univ., Kampala (Uganda). Dept. of Zoology); Kangwagye, T.N.; Semakula, L.; Ndyabahika, C.; Esiru, P. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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Historically, the potentially highly agricultural productive areas of Uganda, bordering the shores of Lake Victoria, have been plagued by the presence of tsetse flies. While Glossina pallidipes was reported to be main vector in the area, evidence has accrued indicating that G. fuscipes fuscipes is in fact the main vector on the island. There is also evidence that the species has adopted a peridomestic behaviour in this, predominantly, farming and fishing community. Since 1987/88, intensive surveys were conducted and current monitoring work concentrates on strategic sites such as water collection points, fishing camps, ports of call and selected villages on the island (Bulopa-Walwanda, Lwenyanga, Kyanamu, Tome, Isiriba and Kachanga). Making use of 20-25 pyramidal traps impregnated with deltamethrin (400 mg/trap) for 20-22 days/month, the G. f. fuscipes population around reference villages was considerably reduced (90-95% after 7-9 months). Arrangements are underway to evaluate insecticides treatments of domestic livestock host animals and monitor trends in the transmission of trypanosomiasis. In collaboration with UTRO, Tororo, experimental rearing of G. F. fuscipes will be undertaken aiming at producing flies for mark-release-recapture studies and trials with sterile flies.

19863 (IAEA-TECDOC-634, pp. 249) **Tsetse and trypanosomiasis at the Ngulia Rhino sanctuary.** Mihok, S. (International Centre of Insect Physiology and Ecology, Nairobi (Kenya)); Munyoki, E.; Jonyo, J.F.; Rottcher, D.; Brett, R.A.; Majiwa, P.O. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

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The conservation of black rhinoceros (Diceros bicornis) in Kenya involves the translocation of rhinoceros to protected sanctuaries, e.g. the recently enlarged 69 km^2 sanctuary at Ngulia in Tsavo West National Park. As the black rhinoceros is known to be particularly susceptible to infection with Trypanosoma brucei, there is a strong possibility that the stress of translocation will induce health problems that would not normally occur in resident populations. Similarly, the movement of animals born in tsetse-free areas to tsetse-infested areas may result in trypanosomiasis problems because of loss of immune protection in the absence of challenge in early life. Finally, there is some concern over the possibility of facilitating genetic exchange in T. brucei through the artificial movement of animals over long distances into novel environments. To aid in the development of prudent management practices, we initiated baseline studies on tsetse distribution and trypanosomiasis at the Ngulia sanctuary. To date, we have completed a dry season survey of tsetse distribution over a 125 km^2 area centred on the sanctuary and have characterized the nature of the trypanosomiasis challenge in different areas. Trypanosomiasis challenge at Ngulia involves a variety of Trypanosoma spp. Nevertheless, an unusual finding is the lack of diversity in Nannomonas parasites, with most belonging to the savannah group of T. congolense.

19864 (INIS-mf-13183, pp. 44) **Standardisation of a baboon under anaesthesia as a model for brain SPECT investigations.** Dormehl, I.C. (AEC Institute for Life Sciences, Faculty of Medicine, University of Pretoria (South Africa)); Redelinghuys, I.F.; Hugo, N.; Oliver, D.; Pilloy, W.P. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. BRAIN/anesthesia; BRAIN/single photon emission computed tomography; ANESTHETICS; BABOONS; BLOOD FLOW; BRAIN; ANESTHESIA; IN VIVO; LABELLED COMPOUNDS; STANDARDIZATION; TECHNETIUM 99

19865 (INIS-mf–13183, pp. 44) **Thiol reduction-mediated ^{99m}Tc-IgG for scintigraphy of inflammatory lesions in the baboon model.** Hugo, N. (AEC Institute for Life Sciences, Faculty of Medicine, University of Pretoria (South Africa)); Dormehl, I.C.; Redelinghuys, I.F.; Louw, W.K.A.; Fourie, P.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. IMMUNOGLOBULINS/technetium 99; IMMUNOGLOBULINS/thiols; BABOONS; FORMALDEHYDE; IMMUNOGLOBULINS; THIOLS; IMMUNOLOGY; IN VIVO; INFLAMMATION; INTRAVENOUS INJECTION; LABELLED COMPOUNDS; LABELLING; SCINTISCANNING; STAPHYLOCOCCUS; SUBCUTANEOUS INJECTION

19866 (INIS-SU–313, pp. 19-22) **Problems of metrological provision of the measurements when monitoring food contamination.** Bregadze, Yu.I.; Komarov, N.A. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342–: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Various aspects of radioactive contamination monitoring of environmental objects and food with regard to sample isotope composition changing in time, are considered. In samples of technogenic origin with relatively low activity a notable difference in data, obtained by gamma-spectrometric analysis and beta-radiometry methods is explained by the effect of natural ^{40}K contained in samples. Recommendations concerning gamma-spectrometry method application to such samples are given.

19867 (INIS-SU–313, pp. 74-77) **Peculiarities of food contamination in the Lithuanian SSR.** Petrulis, R.A. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342–: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental data of radiochemical investigations by Radiologic laboratory of the Republican Public Health Service including the determination of ^{137}Cs and ^{90}Sr content in samples of water, milk, fish, bread, meat, vegetables and fruit are presented. ^{131}I detection in milk samples and γ-background measurement in a number of Lithuanian regions have been performed since the Chernobyl accident. 2 refs.; 2 tabs.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 17932, 18105, 18311, 19376, 19412, 19413, 19432, 19453, 19477, 19531, 19566, 19575, 19649, 19811, 19812, 19824, 19866, 19867, 20442

19868 (AECL–9825-1) **Supplement to dose conversion factors for air, water, soil and building materials.** Holford, R.M. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Aug 1989. 405p. Order Number DE92626202. Source: OSTI; NTIS (US Sales Only); INIS.

The calculations described in the original report, AECL-9825, have been repeated on a more recent database obtained from Oak Ridge National Laboratories (US). This database was apparently derived from the Evaluated Nuclear Structure Data File (ENSDF) and was used as the basis for the preparation of ICRP publication number 38. Data for 826 nuclides are given, including Argon-42 which was added to the database manually. Because the new database is more detailed than that used previously, and the beta-spectrum calculation sub-routine was improved, these new calculations are believed to be more accurate than those in the original report. This report does not entirely replace the original version, however, since there are a few nuclides that were included in that report but not in the current one.

19869 (AECL–9959, pp. 287-293) **Assessing the distribution of radioresponse in human populations: Individual variation in radiosensitivity and possible relations to radiogenic cancer risk.** Morrison, D.P. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Gentner, N.E.; Werner, M.M. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jun 1989. (CONF-8903142–: Workshop/symposium on radiation protection: past and future, Chalk River (Canada), 20-22 Mar 1989). In *Proceedings of the workshop/ symposium on radiation protection: past and future.* 346p. Order Number DE92620360. Source: OSTI; NTIS (US Sales Only); INIS.

Using a novel assay to assess the radiosensitivity of lymphoblastoid cell lines developed from individual donors, we have shown that the radioresponses of lymphoblastoid cell lines derived from ostensibly normal persons may cover a wide range. By comparison to lines of known radiosensitivity, a significant proportion of these normal lines may exhibit extreme hypersensitivity. Abnormal radiosensitivity in the in vitro assay appears attributable to deficient ability to accomplish effective DNA repair of ionizing radiation-induced DNA damage, and may serve to identify a subset of the population with greater-than-expected susceptibility to 'spontaneous', and possibly radiogenic, cancer. Identification of susceptible subpopulations may affect radiation protection practices in the future.

19870 (AECL–10293) **Causes of death among long-term employees of Chalk River Laboratories, 1966-1989.** Werner, M.M.; Myers, D.K. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Nov 1990. 22p. Order Number DE92626201. Source: OSTI; NTIS (US Sales Only); INIS.

Data on mortality among long-term employees of Chalk River Laboratories to 1989 December 31 are reported. The 1988 Hare report, entitled The Safety of Ontario's Nuclear Power Reactors, noted that there had been a steady rise in standardized mortality ratios (SMR) for cancer among these employees in the last three successive five-year periods from 1971-75 to 1981-85. None of the SMRs was significantly different from unity; however, the apparent trend could be indicative of the development of latent cancers. The present report was prepared to see if that increasing trend in cancer SMRs continued. In the years 1986-89, the SMR for cancer among long-term male employees was exceptionally low. The wide fluctuations seen in our data over time are likely anomalies arising from the small size of the study group rather than problems arising from radiation exposures on site.

19871 (AERE-R–13826) **Interception of radioactive fallout by vegetation.** Chamberlain, A.C.; Garland, J.A. AEA Environment and Energy, Harwell (United Kingdom). Dec 1991. 18p. Order Number DE92627979. Source: OSTI; NTIS (US Sales Only); INIS.

A review has been carried out of information on the fraction of radioactive material, deposited by dry or wet deposition processes, that is intercepted by vegetation. The amount of information available is limited, but it is clear that a substantial fraction may be intercepted in some circumstances. In dry deposition, the results of measurements indicate that interception decreases with increasing particle size for particles larger than about 40 μm. In low volume water sprays, interception fractions for ^{7}Be, ^{89}Sr and microspheres of 3 to 25 μm diameter were similar, but that for periodate was lower. The fraction intercepted decreased with an increase in the amount of simulated rainfall. The data are particularly sparse for dry deposition of particles smaller than 30 μm diameter. In addition, there is no information on interception at the moderate rates of rainfall common in Britain, and little is known of the differences between various species of plants. (author).

19872 (CONF-9203121-2) **Dose conversion factors.** Kocher, D.C.; Eckerman, K.F. Oak Ridge National Lab., TN (United States). [1992]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Pathway analysis and risk assessment for environmental compliance and dose reconstruction; Kiawah Island, SC (United States); 2-6 Mar 1992. Order Number DE92011036. Source: OSTI; NTIS; INIS; GPO Dep.

The following is discussed in this report: concepts and quantities used in calculating radiation dose from internal and external exposure. Tabulations of dose conversion factor for internal and external exposure to radionuclides. Dose conversion factors give dose per unit intake (internal) or dose per unit concentration in environment (external). Intakes of radionuclides for internal exposure and concentrations of radionuclides in environment for external exposure are assumed to be known. Intakes and concentrations are obtained, e.g., from analyses of environmental transport and exposure pathways. differences between dosimetry methods for radionuclides and hazardous chemicals are highlighted.

19873 (DOE/ER/60621-5) **Repair of uv damaged DNA: Genes and proteins of yeast and human: Progress report, November 1, 1991–April 15, 1992.** Prakash, L. Rochester Univ., NY (United States). School of Medicine and Dentistry. Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER60621. Order Number DE92013002. Source: OSTI; NTIS; GPO Dep.

Our objectives are to determine the molecular mechanism of the incision step of excision repair of ultraviolet (UV) light damaged DNA in eukaryotic organisms, using the yeast Saccharomyces cerevisiae as a model system, and to study the human homologs of yeast excision repair and postreplication repair proteins progress is described.

19874 (GSF-30/91) **The calculation of dose from external photon exposures using reference human phantoms and Monte Carlo methods. Pt. 6. Organ doses from computed tomographic examinations.** Zankl, M. (GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Strahlenschutz); Panzer, W.; Drexler, G. GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Nov 1991. 126p. Contract CEC 890071. Order Number DE92511441. Source: OSTI; NTIS (US Sales Only); INIS.

Computed tomography (CT) is a technique which offers a high diagnostic capability; however, the dose to the patient is high compared to conventional radiography. This report provides a catalogue of organ doses resulting from CT examinations. The organ doses were calculated for the type of CT scanners most commonly used in the FRG and for three different radiation qualities. For the dose calculations, the patients were represented by the adult mathematical phantoms Adam and Eva. The radiation transport in the body was simulated using a Monte Carlo method. The doses were calculated as conversion factors of mean organ doses per air kerma free in air on the axis of rotation. Mean organ dose conversion factors are given per organ and per single CT slice of 1 cm width. The mean dose to an organ resulting from a particular CT examination can be estimated by summing up the contribution to the organ dose from each relevant slice. In order to facilitate the selection of the appropriate slices, a table is given which relates the mathematical phantoms' coordinates to certain anatomical landmarks in the human body. (orig.).

19875 (HW-13467) **Further proof tests of atomic weapons.** Parker, H.M. Hanford Works, Richland, WA (United States). 23 May 1949. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92010884. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/safety; HANFORD RESERVATION/personnel; HANFORD RESERVATION/radioactive effluents; NUCLEAR EXPLOSIONS/radiation doses; PERSONNEL/radiation doses; SAFETY; PERSONNEL; SHIELDING; RADIATION TRANSPORT; FALLOUT

19876 (IAEA-TECDOC-634, pp. 127) **Effect of irradiation on tsetse flies.** Molyneux, D.H. (Salford Univ., Salford (United Kingdom). Dept. of Biological Sciences); Stiles, J.K. International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Jan 1992. (CONF-9102172-: Seminar on African animal trypanosomiasis: Tsetse control, diagnosis and chemotherapy using nuclear techniques, Muguga (Kenya), 11-15 Feb 1991). In *Tsetse control, diagnosis and chemotherapy using nuclear techniques: Proceedings of a seminar held in Muguga, Kenya, 11-15 February 1991.* 259p. Order Number DE92626120. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only.

We have investigated the effects of irradiation on Glossina species which have been the subject of sterile male release compaigns in West Africa. From these studies it is clear that (i) irradiation at standard doses used in SIT causes substantive damage to Glossina midgut and markedly changes peritrophic membrane structure, (ii) irradiation effects reduce levels of lectins and lysin secretion by Glossina midgut cells, (iii) irradiation inhibits production of midgut proteases and (iv) these changes create conditions for enhanced growth of trypanosomes in the midgut. In addition, major differences in the biochemical profile of G. palpalis palpalis and G. p. gambiensis have been found particularly in midgut lectins and lysins and in the characteristics of salivary gland binding using labelled lectins. It is clear that G. p. palpalis (from the Vienna in vitro fed stock colony) is refractory to Trypanozoon and that its contribution to the transmission of trypanosomes (Nannomonas and Trypanozoon) in areas where this subspecies has been released is probably negligible. This study highlights the need to assess vectorial capacity of target species precisely and evaluate cost-effectiveness of any inputs in relation to control benefits.

19877 (INFO-0206(add.)) **Comparison of the distribution of non-radiological and radiological fatal risk in Ontario industries (addendum).** Davis, C.K. (Waterloo Univ., ON (Canada)); Forbes, W.F.; Hayward, L.M. Atomic Energy Control Board, Ottawa, ON (Canada). Sep 1986. 16p. Order Number DE92628369. Source: OSTI; NTIS (US Sales Only); INIS.

Addendum to report INFO-0206.

Occupational limits for exposure to ionizing radiation, in force in Canada, are based on recommendations of international bodies, particularly the International Commission on Radiological Protection (ICRP). To determine whether the ICRP assertions concerning the similarity of the distributions of occupational risk at the higher risk levels (from non-radiation and from radiation work) to Canada a study of the high end of the distributions of non-radiological risk of occupational fatalities in the province of Ontario was performed. For the present study total doses from exposure to sources of ionizing radiation for Ontario workers were converted to relative risk rates to allow direct comparison with the non-radiological results. In addition, absolute values for the radiological risk rates (RRR) were derived. The radiological risk estimates are based on workers who work both from nuclear reactions and from X-rays. The conclusion is made that the radiological and non-radiological risk rate (NRRR) distributions are similar in shape, but the RRR are approximately 1 to 27 percent of the NRRR, depending on the industry concerned.

19878 (INIS-BR-2922, pp. 304) **Introduction of radioprotection supplementary measures during the realization of studies with radioaerosol propose of a device against environmental contamination.** Braga, F.J.H.; Bouladour, H.; Hindie, E.; Gambini, D.J.; Barritault, L.; Galle, P.; Iagizi, N. Sociedade Brasileira de Radiologia, Sao Paulo, SP (Brazil). 1991. 450p. (In Portuguese). (CONF-9110365-: 23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of, Sao Paulo (Brazil), 11-15 Oct 1991). In *Proceedings of the 23. Brazilian Congress on Radiology; 21. Meeting on Radiology from Sao Paulo; 10. Course of Recycling; 6. Congress of Technician on Radiology from Sao Paulo; 1. Congress from South-East Region of Technician on Radiology.* Order Number DE92626267. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RESPIRATORS/patients; RESPIRATORS/radiation protection; RESPIRATORS/radioactive aerosols; AEROSOL MONITORING; NUCLEAR MEDICINE; RESPIRATORS; PATIENTS

19879 (INIS-mf–13182) **Report of the United Nations Scientific Committee on the Effects of Atomic Radiation: General Assembly. Official records: Forty-third session, suppl. no. 45 (A/43/45).** United Nations Scientific Committee on the Effects of Atomic Radiation, New York, NY (USA). Aug 1988 78p. Order Number DE92626023. Source: OSTI; NTIS (US Sales Only); INIS.

The report summarizes the main conclusions of specialized studies on the effects of atomic radiation on man. The material is divided into a historical review, in which the developments and trends that have become apparent throughout the years are presented, and a discussion of the present situation, highlighting the conclusions drawn from the most recent studies on radiation physics and biology. The report is written at a general level; the scientific annexes, to be published separately, forming the basis for the report's conclusions are written in a format essentially aimed at specialists. 2 figs, 11 tabs.

19880 (INIS-mf–13183, pp. 37) **Repair of radiation induced damage in cells.** Hunter, A.; Duffet, R.; Hendrikse, A.; Blekkenhorst, G. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIATION INJURIES/biological repair; ANIMAL CELLS; FRACTIONATED IRRADIATION; PH VALUE; RADIATION DOSES; TEMPERATURE DEPENDENCE; TIME DEPENDENCE

19881 (INIS-mf–13183, pp. 44) **Chromosomal aberrations in human lymphocytes - response to mixed neutron/photon exposures.** Slabbert, J.P. (National Accelerator Centre, Faure (South Africa)); Hough, J.H.; Jansen, S. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. LYMPHOCYTES/chromosomal aberrations; BLOOD; COBALT 60; GAMMA RADIATION; LET; LYMPHOCYTES; MEV RANGE 01-10; MUTATION FREQUENCY; NEUTRONS; PHOTONS; RADIATION DOSES; SYNERGISM

19882 (INIS-mf–13183, pp. 45) **Radiation-induced transformation of human fibroblasts: studies of anchorage independence.** Renan, M.J. (National Accelerator Centre, Faure (South Africa)); Nwankwo, J.; Landolph, J.; Hill, C. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. FIBROBLASTS/cell transformations; AGAR; CARCINOGENS; CELL CULTURES; CELL PROLIFERATION; CESIUM 137; COLONY FORMATION; FIBROBLASTS; IONIZING RADIATIONS; SYNERGISM; TUMOR CELLS

19883 (INIS-mf–13183, pp. 46) **Fluorescence spectroscopy of normal atherosclerotic human artery wall using a XeCl laser.** Bhagwandin, N. (Directorate: Radiation Control, Department of National Health, Bellville (South Africa)); Breuer, H.; Bunn, T. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ARTERIES/excimer lasers; ARTERIES/fluorescence spectroscopy; ARTERIES; ARTERIOSCLEROSIS; CHLORINE; FILTERS; IN VITRO; MICROCOMPUTERS; MONOCHROMATORS; PHOTOTUBES; SPECTROMETERS; TISSUES; XENON

19884 (INIS-mf–13183, pp. 37) **The effect of fractionation with neutrons on the mouse foot.** Blekkerhorst, G.H. (Groote Schuur Hospital, Cape Town (South Africa). Dept. of Radiotherapy); Jones, D.T.L. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. FRACTIONATED IRRADIATION/neutrons; BEAMS; BIOLOGICAL REPAIR; FEET; NEUTRONS; IONIZING RADIATIONS; LET; MICE; NEUTRON THERAPY; RADIATION INJURIES; RADIOTHERAPY

19885 (INIS-mf–13183, pp. 37) **A whole body plethysmographic method for measuring mouse breathing rates.** Duffet, R. (Cape Town Univ. (South Africa). Dept. of Radiotherapy); Blekkenhorst, G.; Abratt, R. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. MICE/breath; ANALOG-TO-DIGITAL CONVERTERS; BLEOMYCIN; BLOOD; BODY; CAPACITANCE; CONSTRUCTION; DOSE LIMITS; FOURIER TRANSFORMATION; IONIZING RADIATIONS; LUNGS; MICE; BREATH; MICROCOMPUTERS; OPERATION; PRESSURE GAGES; RADIATION DOSES; SIZE; TISSUES; VOLUME

19886 (INIS-mf–13183, pp. 36) **Blood volume determination for ticks using radioisotopes.** Burger, L.B. (Medical Univ. of Southern Africa (MEDUNSA), Pretoria (South Africa)); Clarke, F.C.; Macki, A.J.; Strydom, W.J.; Rechav, Y. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. TICKS/blood plasma; TICKS/radioisotopes; CHROMIUM 51; COMPARATIVE EVALUATIONS; ERYTHROCYTES; GOATS; HOST; IODINE 125; SCINTILLATION COUNTERS; TICKS; RADIOISOTOPES

19887 (INIS-mf–13183, pp. 36) **Comparison of two radioaerosols for the assessment of mucociliary clearance in normal volunteers.** Burger, L.B. (Medical Univ. of Southern Africa (MEDUNSA), Pretoria (South Africa)); Strydom, W.J.; Brandt, H.D. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. LUNG CLEARANCE/aerosols; COMPARATIVE EVALUATIONS; DRUGS; ERYTHROCYTES; GAMMA CAMERAS; IMAGES; AEROSOLS; LUNGS; TECHNETIUM 99

19888 (INIS-mf–13183, pp. 39) **Rehabilitation of a radioactive sulphuric acid site.** Van Dongen, E.; Lalkhan, M. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SULFURIC ACID/radioactivity; CHEMICAL WASTES; CONTAMINATION; DECOMMISSIONING; GOLD; MANAGEMENT; MINES; OPERATION; PERSONNEL; PYRITE; SOUTH AFRICAN ORGANIZATIONS; RADIOACTIVITY

19889 (INIS-mf–13183, pp. 34) **Analysis of radiation doses to the public from ^{131}I-treatment of thyrotoxic out-patients.** Wasserman, H.J. (Tygerberg Hospital, Bellville (South Africa));

Klopper, J.F. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. RADIATION DOSES/iodine 131; RADIATION DOSES/public health; ALARA; DOSE LIMITS; HYPOTHYROIDISM; ICRP; PATIENTS; RADIATION DOSE UNITS; THERAPY

19890 (INIS-mf-13183, pp. 35) **3D patient contour determination from multiple radiographs.** Willemse, C.A. (Orange Free State Univ., Bloemfontein (South Africa). Dept. of Biophysics); Bloch, P.; Altschuler, M.D. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. IMAGES/three-dimensional calculations; ALGORITHMS; IMAGES; RADIATION DOSES; SIMULATION; SURFACES; TISSUES

19891 (INIS-mf-13183, pp. 39) **On the use of '3-Dimensional Kriging' for the analysis of TLD measurements of environmental radiation levels at the Koeberg power station.** Micali, V. (Eskom, Generation Strategic Planning, Megawatt Park, Sandton (South Africa)); Boshoff, N. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIOACTIVITY/thermoluminescent dosemeters; RADIOACTIVITY/three-dimensional calculations; ENVIRONMENT; KOEBERG-1 REACTOR; KOEBERG-2 REACTOR; RADIOACTIVITY; REACTOR SITES; SPATIAL DISTRIBUTION; STATISTICS; TEMPORAL DOSE DISTRIBUTIONS

19892 (INIS-mf-13183, pp. 39) **Radiological environmental monitoring in mining and industry.** Brits, R.J.N. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RADIATION MONITORING/environment; RADIATION MONITORING/public health; INDUSTRY; MINING; NATURAL RADIOACTIVITY; NUCLEAR INDUSTRY; ENVIRONMENT; RADIOISOTOPES

19893 (INIS-mf-13183, pp. 40) **Underground radiation survey strategy in a South African gold mine.** Guzek, J. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. GOLD/mining; ALPHA PARTICLES; BETA PARTICLES; EXTERNAL IRRADIATION; GAMMA RADIATION; GOLD; MINING; INHALATION; MINERALS; OCCUPATIONAL EXPOSURE; RADIATION DOSES; RADIATION HAZARDS; RADIATION PROTECTION; RADON; RADON 220; SOUTH AFRICAN ORGANIZATIONS; UNDERGROUND MINING

19894 (INIS-mf-13183, pp. 41) **Radiological risk perspective in mining.** De Beer, G.P. (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. MINING/occupational exposure; MINING/occupational safety; COMPARATIVE EVALUATIONS; DOSE LIMITS; GOLD; MINING; MORTALITY; RADIATION HAZARDS; RADIATION PROTECTION; SOUTH AFRICAN ORGANIZATIONS; URANIUM

19895 (INIS-mf-13183, pp. 41) **Nuclear power station occupational exposure experience in South Africa.** Keenan, N.H. (Council for Nuclear Safety, Verwoerdburg (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. NUCLEAR POWER PLANTS/occupational exposure; COMPARATIVE EVALUATIONS; DOSE LIMITS; PERSONNEL DOSIMETRY; PWR TYPE REACTORS; SOUTH AFRICAN ORGANIZATIONS

19896 (INIS-mf-13183, pp. 41) **The practical application of the ALARA principle.** De Klerk, L. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ALARA/uses; ALARA; USES; COST; DOSE LIMITS; NUCLEAR FACILITIES; OCCUPATIONAL EXPOSURE; OPTIMIZATION; PERSONNEL MONITORING; RADIATION DOSES; RADIATION PROTECTION

19897 (INIS-mf-13183, pp. 45) **Radiation dose assessment using micronuclei in binucleate lymphocytes.** Slabbert, J.P. (National Accelerator Centre, Faure (South Africa)); Jansen, S.; Buckle, C. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. LYMPHOCYTES/radiation doses; COBALT 60; CYTOPLASM; DOSIMETRY; FAST NEUTRONS; IRRADIATION; LYMPHOCYTES; MICROSCOPY; POISSON EQUATION; RADIATION ACCIDENTS; RADIATION DOSE UNITS

19898 (INIS-mf-13183, pp. 43) **Cavity theories applied to ^{60}Co and electron beams.** Eloff, S.M.Z. (Medical Univ. of Southern Africa, Pretoria (South Africa). Dept. of Medical Physics); Strydom, W.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132-: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. CAVITIES/cobalt 60; CAVITIES/electron beams; CARBON; CAVITIES; COMPARATIVE EVALUATIONS; ELECTRONS; ENERGY DEPOSITION; LITHIUM FLUORIDES; MEV RANGE 01-10; MEV RANGE 10-100; MONTE CARLO METHOD; PHOTONS; POLYSTYRENE; RADIATION DOSES; STOPPING POWER; WATER

19899 (INIS-mf-13192, pp. 149-150) **Biophysical mechanisms of the ionizing radiation effect and their importance in medicine.** Lokajicek, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Judas, L.; Prokes, K. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990).

In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The lethal effect of various kinds of radiation is usually characterized by the survival curve, or the S(D) function, expressing the fraction of cells persisting after the application of dose D. Detailed analysis based on data obtained in vivo demonstrates that the survival curves can generally have a rather complex shape. The principal damage responsible for the lethal effect consists in the so-called double fractures of chromosomal DNA molecules, resulting in combinations of adjacent single fractures in the two chains of the molecule. Damage of all the other systems can be repaired by the cell rather easily. Thus, the shape of the survival curve is generally governed by the formation of the double fractions as well as by the rate of the repair process. In the radiotherapy of tumor diseases, the tumor focus is destructed while sparing, as far as possible, the healthy cells from which the proliferation and restitution of the tissue should proceed. This can be achieved by fractionation of the total dose. The fractionation regime is characterized by the total dose D, total exposure T and the number of fractions. (Z.S.). 4 refs.

19900 (INIS-mf--13192, pp. 278) **The effect of ionizing particles on cells and tissues.** Judas, L. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Lokajicek, M.; Prokes, K. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ANIMAL CELLS/biological radiation effects; TISSUES/biological radiation effects; IONIZING RADIATIONS; MATHEMATICAL MODELS; TISSUES

19901 (INIS-SU--313) **Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.** AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are processed separately for the database.

19902 (INIS-SU--313, pp. 58-62) **Experience and problems of investigating ^{137}Cs migration peculiarities within the system food-man in the region of the Lithuanian SSR.** Nedvetskajte, T.N.; Dauskurdis, S.I.; Filistovich, V.I.; Tamulenajte, O.P.; Krushinskene, Z.M.; Petrulis, R.A. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Evaluation of a dose of internal irradiation of a human living in the Lithuanian territory, obtained during several years as a result of using domestic food stuffs contaminated with radioactive cesium (^{137}Cs) due to the Chernobyl NPP accident is presented. A mathematical model allowing one to obtain an evaluation of a change with time of a radionuclide content in a human body, as well as of the absorbed β- and γ-radiation dose rate is presented. It is shown that according to the data available on the cesium isotope concentrations in food stuffs in the Lithuanian territory the dose of internal irradiation did not exceeded 1 mZv for the first two years after the accident. 3 refs.; 4 figs.

19903 (INIS-SU--313, pp. 70-73) **Determination of the ^{90}Sr and ^{137}Cs concentration factor by some cereals and root crops in the region of the Lithuanian SSR.** Krushinskene, Z.N. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

Effect of natural-soil conditions on ^{90}Sr and ^{137}Cs accumulation factor (AF) in barley plants is studied at the Lithuanian republican chemization station. It is shown that in most cases AF is higher in barley grown in the Eastern part of Lithuania and in the Mid-Lithuanian lowland. Study of effect of continuous utilization of fertilizers on radionuclide accumulation in sugar beet has demonstrated an increase of ^{90}Sr and ^{137}Cs content in the soil (up to 1.5 times) and in sugar beet (up to 2 times) as compared to the section under control. 3 refs.; 1 tab.

19904 (INIS-SU--313, pp. 23-29) **On radioecological monitoring in the region of the Lithuanian SSR.** Butkus, D.V. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

State of radioecological monitoring in the region of Lithuania is considered. It is shown that detection of radioactive substances in the atmosphere, plants, food stuff in the republic is conducted in several Laboratories, therefore the data obtained are dissipated in various organizations. In connection with radioactive pollution of Lithuanian territory due to the Chernobyl accident and Ignalinsk NPP operation it is proposed to expand scientific investigations into radioactive pollution of the environment and to create a system of interdepartmental radioecologic monitoring. The radioecologic data obtained should be accumulated and processed using a computer, analysed and stored in a data bank of the republican radiometering laboratory. 3 figs.

19905 (INIS-SU--313, pp. 30-42) **Optimization of radioecological monitoring.** Volkov, N.G.; Salimov, O.N. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

A mathematical model of optimal radiation monitoring in a two-dimensional radiation field is developed. A mathematical model of radionuclide scattering in the atmosphere, density of population distribution across the territory, response function (radiation cancerogenesis dose-effect), mean square error of a single measurement and the goal function appear to be the source components of the model. The model allows one to determine the optimal density of radiation monitoring point distribution and the optimized system efficiency (the ratio of measurement number in non-optimized and optimized systems). The calculations are performed using Mega-CAMAC/SM-4 computer with MSI program, CF1 subprogram and standard SIMQ program written in FORTRAN. It is shown that application of optimal weight factors allows one to 10 times reduce the amount of measurements. The choice of points with minimal dispersion of the expected number of biologic effects allows one to several times increase the optimized observation system efficiency. 3 refs.; 5 tabs.

19906 (INIS-SU--313, pp. 51-57) **Realization of personnel dosimetry for population external irradiation.** Korenkov, I.P.; Pol'skij, O.G.; Zhukovskij, V.G.; Voronin, K.V. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342--: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems* *of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

In connection with radioactive contamination of the territory of a number of republics as a result of the Chernobyl NPP accident, organization of personal dosimetry (PD) of external irradition of population is considered. It is shown that personal dosimetry is a component of the work of the public health services (PHS). The equipment applied is considered, in which case the prospects of thermoluminescence dosimeters is underlined. Functions of groups and single PD sections of regional, district and republican PHS are enumerated. Example of calculating an optimal number of persons subjected to PD, is given. It is proposed to use the Electronika-type microcomputers for accumulation and primary processing of data. 7 refs.; 1 tab.

19907 (INIS-SU-313, pp. 63-65) **Approximated method of regeneration of specific radioactivity of biological wastes.** Voronin, K.V.; Karklinskaya, O.N.; Kozlov, A.A.; Sobolev, A.I. AN SSSR, Moscow (USSR); AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki. 1988. 91p. (In Russian). (CONF-8804342-: Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring, Vilnius (USSR), 20-22 Apr 1988). In *Experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring.* Order Number DE92001358. Source: OSTI; NTIS (US Sales Only); INIS.

An express-method for regeneration of specific activity by the value of exposure dose rage, applied for express-evaluation of biologic wastes of mean and low specific activity, is proposed. It is ensured with 0.99 probability therewith that for low and mean activity biological wastes the empiric dependence regenerated is empiric. 3 refs.; 1 tab.

19908 (LBL-31398) **Problems in mechanistic theoretical models for cell transformation by ionizing radiation.** Chatterjee, A.; Holley, W.R. Lawrence Berkeley Lab., CA (United States). Oct 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9109107-5: Workshop on biophysical modelling of radiation effects, Padua (Italy), 2-5 Sep 1991). Order Number DE92010265. Source: OSTI; NTIS; GPO Dep.

A mechanistic model based on yields of double strand breaks has been developed to determine the dose response curves for cell transformation frequencies. At its present stage the model is applicable to immortal cell lines and to various qualities (X-rays, Neon and Iron) of ionizing radiation. Presently, we have considered four types of processes which can lead to activation phenomena: (1) point mutation events on a regulatory segment of selected oncogenes, (2) inactivation of suppressor genes, through point mutation, (3) deletion of a suppressor gene by a single track, and (4) deletion of a suppressor gene by two tracks.

19909 (LBL-31685) **Relating space radiation environments to risk estimates.** Curtis, S.B. Lawrence Berkeley Lab., CA (United States). Oct 1991. 24p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9110312-2: NATO Advanced Studies Institute on the biological effects and physics of solar and galactic cosmic radiation conference, Faro (Portugal), 13-22 Oct 1991). Order Number DE92010256. Source: OSTI; NTIS; GPO Dep.

This lecture will provide a bridge from the physical energy or LET spectra as might be calculated in an organ to the risk of carcinogenesis, a particular concern for extended missions to the moon or beyond to Mars. Topics covered will include (1) LET spectra expected from galactic cosmic rays, (2) probabilities that individual cell nuclei in the body will be hit by heavy galactic cosmic ray particles, (3) the conventional methods of calculating risks from a mixed environment of high and low LET radiation, (4) an alternate method which provides certain advantages using fluence-related risk coefficients (risk cross sections), and (5) directions for future research and development of these ideas.

19910 (LMF-134) **Inhalation Toxicology Research Institute annual report, October 1, 1990-September 30, 1991.** Shyr, L.J.; Finch, G.L.; Bradley, P.L. (eds.). Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (United States). Inhalation Toxicology Research Inst. Dec 1991. 307p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76EV01013. Order Number DE92012104. Source: OSTI; NTIS; GPO Dep.

This report from the Inhalation Toxicology Research Institute describes research in the following areas: characterization of airborne materials and generation of experimental exposure atmospheres; deposition and clearance of inhaled toxicants; metabolism and markers of inhaled toxicants; carcinogenic responses and noncarcinogenic responses to inhaled toxicants; mechanisms of carcinogenic responses and noncarcinogenic responses to inhaled toxicants; University of Utah studies of injected actinides; mathematical modeling applications. (CBS)

19911 (LUMEDW-MEMR-1002) **Radiation dosimetry using magnetic resonance imaging: Development of a dosimeter gel for measurements of 3D dose distribution in radiotherapy.** Olsson, L.E. Lund Univ., Malmoe (Sweden). Dept. of Radiation Physics. 13 Dec 1991. 108p. Order Number DE92626220. Source: OSTI; NTIS (US Sales Only); INIS.

A new dosimetry system for 3D dose distribution measurements based on the Fricke dosimeter and magnetic resonance imaging (MRI) has been developed. The dosimeter consists of a ferrous sulphate solution incorporated in an agarose gel, which together constitute the dosimeter gel. The absorbed dose to the gel is measured by means of the proton spin-lattice relaxation rate, 1/T1 in an MR scanner. The dose distribution to an arbitrary slice within a dosimeter gel phantom can thus be determined. The chemical yield of the dosimeter gel is significantly higher than that of the for Fricke solution, and is strongly dependent of the initial ferrous sulphate concentration, assuming that the gel is bubbled with oxygen during preparation. A gel of 1.5 mM [Fe^{2+}] and 50 mM [H_2SO_4] has a sensitivity of 0.108 $s^{-1}Gy^{-1}$ and is linear up to 50 Gy. The dosimeter gel has uniform dose response over large volumes. Above 50 mM[H_2SO_4] the yield increases only slightly, but the gel strength decreases and results in gel phantoms with non-uniform dose response. Below 50 mM[H_2SO_4] the sensitivity of the dosimeter falls rapidly due to the decreased relaxivity of the ferric ions. The high chemical yield can be explained by a chain reaction and a reaction scheme is accordingly proposed. The dosimeter gel shows no dependence on dose rate or radiation quality and can be regarded as water-equivalent with respect to the interaction of the radiation. The diffusion coefficient of the ferric ions in the agarose gel is 1.19×10^{-2} cm^2/h. The diffusion blurs the dosimeteric image, but poses only a minor problem if the MR measurements are completed within the first two hours after irradiation. Dose distribution data from external radiation therapy units have been determined using the dosimeter gel and MRI with good accuracy, but the precision is poor, about 5-10%. (au) (84 refs.).

19912 (NEI-NO-196) **Measures against nuclear accidents: Recommendations on further strengthening of Norwegian preparedness against nuclear accidents.** Sosialdepartementet, Oslo (Norway). Jan 1992 179p. (In Norwegian). Order Number DE92628035. Source: OSTI; NTIS (US Sales Only); INIS.

A select committee appointed by the Norwegian Ministry of Social Affairs put forward proposals concerning measures for the improvement of radiation protection preparedness in Norway. On the basis on an assessment of the potential radiation accident threat, the report examines the process of response, and identifies the organizational and management factors that influence that process.

19913 (NEI-NO-197) **Radiation protection for the patient in X-ray diagnostics: Gonad shielding.** SIS Raad. Statens Inst. for Straalehygiene, Oslo (Norway). 1991 10p. (In Norwegian). Order Number DE92628040. Source: OSTI; NTIS (US Sales Only); INIS.

This publication describes the Code of Practice for gonade shielding in X-ray diagnostics. The intention is to achieve common routines in Norwegian health institutions.

19914 (NPL-RSA(EXT)-18) **Intercomparison of the medium energy primary standards for X-ray exposure of NPL and ENEA, Italy.** Moretti, C.J. (National Physical Lab., Teddington

(United Kingdom). Div. of Radiation Science and Acoustics); Heaton, J.A.; Laitano, R.F.; Toni, M.P. National Physical Lab., Teddington (United Kingdom). Apr 1991. 16p. Order Number DE92626192. Source: OSTI; NTIS (US Sales Only); INIS.

An intercomparison between the primary standards of exposure for medium energy X-rays held by the National Physical Laboratory (NPL) and ENEA in Italy is described. The intercomparison, using four different transfer chambers, took place at NPL in December 1989 and at ENEA during March 1990. Measurements were made at four therapy-level qualities, with half value layers of 0.15, 0.5, 1.0 and 2.5 mm Cu (nominal generating voltages of 100, 135, 180 and 250 kV respectively). At the 2.5 mm Cu HVL quality the primary standards were found to agree to within about 0.8%; for the other three qualities the chambers differed by no more than 0.3%. (author).

19915 (NPL-RSA(EXT)–19) **Intercomparison of the low energy primary standards for X-ray exposure of NPL and ENEA, Italy.** Moretti, C.J. (National Physical Lab., Teddington (United Kingdom). Div. of Radiation Science and Acoustics); Heaton, J.A.; Laitano, R.F.; Toni, M.P. National Physical Lab., Teddington (United Kingdom). May 1991. 11p. Order Number DE92626193. Source: OSTI; NTIS (US Sales Only); INIS.

An intercomparison between the primary standards of X-ray exposure for low energy X-rays held by the National Physical Laboratory (NPL) in the United Kingdom and ENEA Italy is described. The intercomparison directly between the two standard chambers took place at NPL during December 1989. Measurements were made at three therapy-level qualities with half value layers of 0.036, 0.25 and 1.00 mm Al (nominal generating voltages of 10, 24 and 50 kV respectively). The two primary standards agreed to within ±0.3%. (author).

19916 (NUREG/CR–5631-Rev.1) **Contribution of maternal radionuclide burdens to prenatal radiation doses: Interim Recommendations: Revision 1.** Sikov, M.R. (Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications); Hui, T.E.; Meznarich, H.K.; Thrall, K.D.; Traub, R.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 156p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–7445-Rev.1). Source: OSTI; NTIS; INIS; GPO.

This report discusses approaches to calculating and expressing radiation doses to the embryo/fetus from internal radionuclides. Information was obtained for selected, occupationally significant radionuclides in chemical forms that provided a spectrum of metabolic and dosimetric characteristics. Fractional placental transfer and/or ratios of concentration in the embryo/fetus to that in the woman were estimated for these materials, and were combined with data from biokinetic transfer models to predict radioactivity levels in the embryo/fetus as a function of stage of pregnancy and time after entry into the transfer compartment or blood of the pregnant woman. Medical Internal Radiation Dosimetry (MIRD) methodologies were extended to formalize and describe details for calculating radiation absorbed doses to the embryo/fetus. Calculations were performed for representative situations; introduction of 1 μCi into a woman's blood at successive months of pregnancy was assumed to accommodate the stage dependence of geometric relationships and biological behaviors. Summary tables of results, correlations, and dosimetric relations, and of tentative generalized categorizations, are provided in the report.

19917 (NUREG/CR–5797) **IMPACTS–BRC, Version 2.1: Code and data verification.** Rao, R.R. (Sandia National Labs., Albuquerque, NM (United States)); Kozak, M.W.; Harlan, C.P.; Bensonhaver, S.D.; Austin, V.; Rollstin, J.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; GRAM, Inc., Albuquerque, NM (United States). Apr 1992. 196p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. (SAND–91-2226). Source: OSTI; NTIS; INIS; GPO.

In the Federal Register, Volume 51, Number 168, NRC has intended the use of IMPACTS-BRC to evaluate petitions for evaluating radioactive waste streams as below regulatory concern. IMPACTS-BRC is a generic radiological assessment code that allows calculation of potential impacts to maximum individuals, waste disposal workers, and the general population resulting from exemption of very low-level radioactive waste from regulatory control. The code allows calculations to be made of human exposure to the waste by many pathways and exposure scenarios. This document describes the code history and the quality assurance work that has been carried out on IMPACTS-BRC. The report includes a summary of all the literature reviews pertaining to IMPACTS-BRC up to Version 2.0. The new code and data verification work necessary to produce IMPACTS-BRC, Version 2.1 is presented. General comments about the models and treatment of uncertainty in IMPACTS-BRC are also given.

19918 (OEFZS–4617) **Results of field studies on ^{90}SR and stable SR soil-to-plant transfer.** Gerzabek, M.H.; Artner, C.; Horak, O.; Mueck, K. Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria). Jan 1992. 20p. Order Number DE92626083. Source: OSTI; NTIS (US Sales Only); INIS.

In 1987 and 1988 at 35 sites plants ready to harvest and the corresponding soils (0 - 20 cm) were collected for ^{90}Sr and stable strontium analyses. Sample preparation and measurement led to a detection limit of 0.008 Bq ^{90}Sr kg^{-1}. The ^{90}Sr-contamination of Austrian soils ranged from 396 to 1998 Bq m^{-2}. Known from literature the contribution of the Chernobyl fallout amounted to app. 25 % of the total contamination. Stable strontium contents of the soils were between 6 and 62.5 mg kg^{-1}. Bariumtriethanolamine extracted 17.7 to 62.3 % of the total stable Sr in soil. ^{90}Sr-concentrations in cereal grains ranged from 0.03 to 0.67 Bq kg^{-1} (fresh wight) for maize and barley, respectively. The values for other foodstuff were between 0.15 (white cabbage) and 0.91 Bq kg^{-1} (spinach). Stable strontium contents were between 0.079 mg kg^{-1} (maize) and 72.5 mg kg^{-1} (celery shoot). The following mean ^{90}Sr soil-to-plant transfer factors for cereal grains were obtained: 0.010 (maize), 0.097 (rye), 0.049 (wheat), 0.095 (barley). Transfer factors for straw were up to 50 times higher (maize). The transfer of ^{90}Sr into vegetables and potatoes reached the same order of magnitude compared to the cereals. In all cases soil-to-plant transfer of stable Sr was clearly lower up to 60 % of the respective values for ^{90}Sr. Thus natural stable strontium is less plant available than ^{90}Sr. The influence of soil parameters on the ^{90}Sr transfer into plants was examinated by correlation analyses. Increasing exchangeable calcium contents of the soils resulted in a significant reduction of Sr soil-to-barley straw transfer. (authors).

19919 (ORNL/TM–11882) **Proceedings of the third conference on radiation protection and dosimetry.** Swaja, R.E.; Sims, C.S.; Casson, W.H. (eds.). Oak Ridge National Lab., TN (United States). Oct 1991. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-911004–: 3. conference on radiation protection and dosimetry, Orlando, FL (United States), 21-24 Oct 1991). Order Number DE92011502. Source: OSTI; NTIS; GPO Dep.

The Third Conference on Radiation Protection and Dosimetry was held during October 21–24, 1991, at the Sheraton Plaza Hotel in Orlando, Florida. This meeting was designed with the objectives of promoting communication among applied, research, regulatory, and standards personnel involved in radiation protection, and providing them with sufficient information to evaluate their programs. To meet these objectives, a technical program consisting of more than 75 invited and contributed oral presentations encompassing all aspects of radiation protection was prepared. General topics considered in the technical session included external dosimetry, internal dosimetry, instruments, accident dosimetry, regulations and standards, research advances, and applied program experience. In addition, special sessions were held to afford attendees the opportunity to make short presentations of recent work or to discuss topics of general interest. Individual reports are processed separately on the database.

19920 (ORNL/TM–11882-Absts.) **Third conference on radiation protection and dosimetry: Program and abstracts.** Oak Ridge National Lab., TN (United States). [1991]. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-911004–Absts.: 3. conference on radiation protection and dosimetry, Orlando, FL (United States), 21-24 Oct

1991). Order Number DE92011594. Source: OSTI; NTIS; INIS; GPO Dep.

This conference has been designed with the objectives of promoting communication among applied, research, regulatory, and standards personnel involved in radiation protection and providing them with sufficient information to evaluate their programs. To partly fulfill these objectives, a technical program consisting of more than 75 invited and contributed oral presentations encompassing all aspects of radiation protection has been prepared. General topics include external dosimetry, internal dosimetry, instruments, regulations and standards, accreditation and test programs, research advances, and applied program experience. This publication provides a summary of the technical program and a collection of abstracts of the oral presentations.

19921 (PNL–6450-51-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report, January 1992.** Finch, S.M.; McMakin, A.H. (comps.). Pacific Northwest Lab., Richland, WA (United States). [1992]. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92011492. Source: OSTI; NTIS; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that individuals and populations could have received from nuclear operations at Hanford since 1944. The project is divided into the following technical tasks. These tasks correspond to the path radionuclides followed, from release to impact on humans (dose estimates): Source Terms, Environmental Transport, Environmental Monitoring Data, Demography, Food Consumption, and Agriculture, and Environmental Pathways and Dose Estimates.

19922 (PNL–6450-52-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report.** Finch, S.M.; McMakin, A.H. (comps.). Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92013442. Source: OSTI; NTIS; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that individuals and populations could have received from nuclear operations at Hanford since 1944. The project is divided into the following technical tasks. These tasks correspond to the path radionuclides followed, from release to impact on humans (dose estimates): source terms; environmental transport; environmental monitoring data; demography, food consumption, and agriculture; environmental pathways and dose estimates.

19923 (PNL–7757-HEDR-Rev.1) **FY 1992 revised task plans for the Hanford Environmental Dose Reconstruction Project: Revision 1.** Shipler, D.B. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92012141. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Hanford Environmental Dose Reconstruction (HEDR) Project is to estimate radiation doses from Hanford Site operations since 1944 to populations and individuals. The primary objectives of work to be performed in FY 1992 is to determine the appropriate scope (space, time, and radionuclides, pathways and individuals/population groups) and accuracy (level of uncertainty in dose estimates) for the project. Another objective is to use a refined computer model to estimate Native American tribal doses and individual doses for the Hanford Thyroid Disease Study (HTDS). Project scope and accuracy requirements defined in FY 1992 can translated into model and data requirements that must be satisfied during FY 1993.

19924 (RIVM–249102006) **Research into the radioactivity of surface waters: Results over 1990.** Sonderen, J.F. van; Drost, R.M.S.; Graber, M.H.; Ockhuizen, A.; Koolwijk, A.C. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). Aug 1991. 32p. (In Dutch). Order Number DE92628044. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summaries in Dutch and English.

This report of the National Institute of Public Health and Environmental Protection (RIVM) contains the results of measurements of radioactivity in the rivers Meuse, Rhine, Roer, in the Westerscheldt, in the Channel of Sas van Gent to Terneuzen, and at some specific locations in the North Sea along the Dutch Coast. The results concern samples taken in 1990. (author). 5 refs.; 8 figs.; 11 tabs.

19925 (SIS–1991:8) **Environmental contamination in the Kautokeino region.** Gjertsen, L. Statens Inst. for Straalehygiene, Oslo (Norway). 1991. 38p. (In Norwegian). Order Number DE92628047. Source: OSTI; NTIS (US Sales Only); INIS.

The National Institute of Radiation Hygiene of Norway has analysed the Cs-137 content in reindeer herdsmen by whole-body measurements with a NaI scintillation counter. The whole-body measurements started in Kautokeino in 1965 and were carried out in March every year until 1990. After the Chernobyl accident in 1986, the whole-body measurements included measurements of Cs-134 with half-life about 2 years. Cs-137 content in meat from legs of reindeer and Se-90 content in the corresponding bones were analysed by National Institute of Radiation Hygiene in the laboratory in Oslo. The samples were supplied by the group of reindeer herdsmen being measured. Also Se-90 content in reindeer meat samples was determined. Cs-137 and Sr-90 content in a few samples of lichens were analysed. 11 refs., 3 figs., 5 tabs.

19926 (SIS–1991:9) **Dose statistics for occupational exposure 1981 - 1990.** Woehni, T. Statens Inst. for Straalehygiene, Oslo (Norway). 1991. 18p. (In Norwegian). Order Number DE92628048. Source: OSTI; NTIS (US Sales Only); INIS.

The report contains annual dose statistics for occupational exposure in Norway for the years 1981 to 1990. For the dosimetry service at the National institute of radiation hygiene (SIS) the total collective dose registered by personal dosemeters has decreased from 5.5 mSv in 1981 to 3.7 mSv in 1990. The number of monitored workers has increased slightly in the same period, and represented in 1990 close to 6000 persons. The total result from the four dosimetry laboratories in Norway amounted in 1990 to approx. 7600 workers and a total registered collective dose of 4.6 mSv. These dose values refer to dosemeter readings as such, with no attempts made to estimate effective doses. Mean annual doses for 1990 ranged from 3.2 mSv for medical radiologists to 0.2 mSv for various industry and service activities within the SIS dosimetry service. The highest overall mean annual doses are 5.8 mSv for radiologists at the Norwegian Radium Hospital, followed by 3.7 mSv reported by the Institutt for energiteknikk in Halden. Trends in annual doses for various occupational groups are presented. 5 refs., 7 figs., 5 tabs.

19927 (SIS–1991:10) **Dietary survey and whole-body counting on reindeer herdsmen of Kautokeino 1989 and 1990.** Boee, E.; Soerlie, A.A. Statens Inst. for Straalehygiene, Oslo (Norway). 1991. 38p. (In Norwegian). Order Number DE92628046. Source: OSTI; NTIS (US Sales Only); INIS.

The dietary study revealed a group characterized by an especially high consumption of reindeer meat, almost 100 kg a year for women and about 150 kg on average for men. Average intake of radiocesium were calculated to 48000 and 39000 Bq by women and 76000 and 58000 Bq by men for the two years, respectively. Both for women and men this indicated a reduction of about 20% from 1989 to 1990. In 1990 samples of reindeer meet were collected for analysis of radiocesium. The average level of radiocesium in the samples were 350-400 Bq/kg. Norwegian Food Control Authorities recommended that individual intake of radiocesium should not exceed 80000 Bq/year, for pregnant and breast-feeding women not more than 40000 Bq/year. For the first year after the Chernobyl accident corresponding levels were set to 400000 and 80000 Bq, respectively. In 1989 42% of the men and 8% of the women had a calculated intake of radiocesium of more than 80000 Bq/year. In 1990 18% of the men and no women exceeded this level. None had an intake of 400000 Bq or more, the highest calculated intake was 162000 Bq. 10 refs., 5 figs., 11 tabs.

19928 (UCRL-CR–109261) **An epidemiologic study of unreported cutaneous malignant melanoma among residents of Alameda and Contra Costa Counties: Final report.** West, D.W. (Northern California Cancer Center, Belmont, CA (United States)); Whittemore, A.S.; Zippin, C.; Lum, D.; Holly, E. Lawrence Livermore National Lab., CA (United States); California Univ., San Francisco, CA (United States); Northern California Cancer Center, Belmont, CA (United States). 12 Nov 1991. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011291. Source: OSTI; NTIS; GPO Dep.

Because of a reported excess of cutaneous malignant melanoma cases at the Lawrence Livermore National Laboratory during the 1970's this study was funded to: determine if the number of cases in Alameda and Contra Costa Counties may have been underreported during 1973–1985 (this is the comparison group used to report an excess of melanoma at the LLNL), and determine if melanoma cases at the LLNL had different melanomas from the comparison population in terms of tumor thickness and therefore aggressiveness of tumors. The results of these two objectives are reported in the form of two papers, each dealing with one of the objectives.

19929 (UWThPh–1991-29) **On the conformal field theory of the two dimensional Ising model.** Maderner, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 1991. 31p. Order Number DE92626055. Source: OSTI; NTIS (US Sales Only); INIS.

An explicit construction of a free and masseless Majorana quantum field theory, which lives on conformal superworld M is presented. Emphasis is posed on the investigation of the action of an infinite dimensional group G of space time symmetries on M. Starting with one particle theory, this action induces a strongly continuous representation of $\mathrm{Diff}^{\approx}{}_{+}(S^1)$ on the single particle Hilbert space. After second quantization the group of implementers turns out to be a non trivial central extension of $\mathrm{Diff}^{\approx}{}_{+}(S^1)$ by U(1), and a Schwinger term occurs, which gives rise to the anomalous transformation law of the energy momentum tensor of the theory. This transformation law is studied, and an interesting connection to geometry is established. (author).

19930 (UWThPh–1991-40) **Dynamical entropy of quantum systems and their abelian counterpart.** Narnhofer, H.; Thirring, W. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 23 Oct 1991. 18p. Order Number DE92625962. Source: OSTI; NTIS (US Sales Only); INIS.

We calculate the dynamical entropy of quasifree automorphisms by showing that their abelian counterpart already gives an optimal abelian model. (authors).

19931 (UWThPh–1991-62) **Quantum topological entropy: First steps of a 'pedestrian' approach.** Hudetz, T. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 13 Dec 1991. 27p. Order Number DE92625963. Source: OSTI; NTIS (US Sales Only); INIS.

We introduce a notion of topological entropy for automorphisms of arbitrary (noncommutative, but unital) nuclear C^*-algebras A, generalizing the 'classical' topological entropy for a homeomorphism $T: X \to X$ of an arbitrary (possibly connected) compact Hausdorff space X, where the generalization is of course understood in the sense that the latter topological dynamical system (with Z-action) is equivalently viewed as the C^*-dynamical system given by the T-induced automorphism of the Abelian C^*-algebra $A = C(X)$ of (complex-valued) continuous functions on X. As a simple but basic example, we calculate our quantum topological entropy for shift automorphisms on AF algebras A associated with topological Markov chains (i.e. 'quantum topological' Markov chains); and also a real physical interpretation of our simple 'quantum probabilistic' entropy functionals is discussed (already in the introduction, anticipating the later definitions and results). (author).

19932 (WSRC-OS–89-94-3) **F/H Area ETF effluent (H-016 outfall) ceriodaphnia survival/reproduction test, test date: December 28, 1989.** Specht, W.L. Westinghouse Savannah River Co., Aiken, SC (United States). Aug 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92013097. Source: OSTI; NTIS; GPO Dep.

This toxicity test was conducted to determine if the effluent from the H/F area of Savannah River Plant affect the survival or reproduction of the test organisms during a seven day period. The test involved exposing the test organisms to a series of dilutions of the effluent. At each dilution the survival and reproduction of ten test organisms was recorded. Each effluent dilution was compared to a control set of test organisms. Survival data were analyzed by Fisher's Exact Test and Probit Analysis to determine the effluent concentration necessary to cause statistically significant ($p=0.05$) mortality. Reproduction data was analyzed for normality, homogeneity of variance and equality of replicates among dilutions to determine the appropriate statistical test for analysis of statistical differences in reproduction among dilutions. Results are summarized.

5602 Thermal Effects

Refer also to citation(s) 19548

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 19467, 19910

19933 (CONF-9105202–, pp. 16, Paper 4) **Static and animated molecular views of a tumorigenic chemical bond to DNA.** Broyde, S. (New York Univ., NY (United States)); Rong Xu; Hingerty, B.E.; O'Handley, S.F.; Krugh, T.R. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract FG02-90ER60931 ;AC05-84OR21400. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Static and dynamic molecular views of a short segment of DNA modified by the tumorigenic aromatic amine 2-acetylaminofluorene (AAF) have been realized by a combination of high resolution nuclear magnetic resonance (NMR) studies in solution and molecular mechanics and molecular dynamics simulations carried out on supercomputers. Thus, the effect of AAF on the structure of the Watson-Crick B-DNA double helix has been elucidated, after two decades of intense interest, via a powerful synergy between state-of-the-art supercomputing and NMR investigations. The AAF is situated in the minor groove of a B-DNA double helix which flexes and bends, and the carcinogen moves between positions where it is stacked with adjacent DNA base and positions where it protrudes further into the groove. The AAF modified DNA base, guanine, is displaced from its normal situation paired with partner cytosine. Also, a base pair adjacent to the modification becomes more mobile. These molecular views offer some possible insight into the early molecular events that may implicate AAF in tumor initiation.

19934 (ETDE-mf–92516652) **Federal German forest survey.** Der Bundesminister fuer Ernaehrung, Landwirtschaft und Forsten informiert. Bundesministerium fuer Ernaehrung, Landwirtschaft und Forsten, Bonn (Germany). Jun 1990 14p. (In German). Order Number DE92516652. Source: OSTI; NTIS (US Sales Only).

On the whole, German forests present a satisfactory picture as to their types and structure. The forests are characterized by stands of spruce and fir, which account for some 43% of the area covered. Stands of pine and larch rank second with 22%. The 33% of area stocked with deciduous trees is essentially characterized by beech (17%) and oak (9%). A reliable survey of novel forest damage is possible only within a relatively short time-span. But the extensive measurements in the framework of the German forest inventory required a period of approximately three years. Therefore, forest damage will continue to be surveyed separately. (orig./VT).

19935 (ETDE-mf–92516820) **Polychlorinated biphenyls and nitrate in food analysed during initial phase of the research project 'German Food Contamination Monitoring Programme'. Progress report no. 14.** ZEBS-Hefte. Weigert, P.; Niermann, R.; Bruland, H.G.; Koenig, F. Bundesgesundheitsamt, Berlin (Germany). Zentrale Erfassungs- und Bewertungsstelle fuer Umweltchemikalien (ZEBS). 1991 105p. (In German). Order Number DE92516820. Source: OSTI; NTIS (US Sales Only).

Within the research project on the monitoring of foods involving 11 Laender of the Federal Republic of Germany (German Food Contamination Monitoring Programme), selected food items were examined for a number of residues and contaminants by the laboratories of official food control in collaboration with the Centre for

Surveillance and Health Evaluation of Environmental Chemicals of the Federal Health Office (ZEBS). In order to guarantee the comparability of analytical results among the 17 laboratories which have participated in the project until March 1990, particular efforts were taken to ensure the quality of analytical data and to harmonize the steps of sampling, sample preparation and recording of data. Samples of beef and pork including several organs, milk, potatoes, lettuce, white cabbage, strawberries and apples were taken according to strictly statistical aspects. Particular attention was paid to the possible seasonal influence on the contamination levels of the products. In the present report, an overview is given of the results obtained up to now for nitrate in foods of vegetal origin and for polychlorinated biphenyls in all food items included in the initial phase of the study. (orig./MG) With 15 tabs., 27 refs., 8 maps, annex with 30 tabs.

19936 (ORNL/TM–12029) **Characterization of explosives processing waste decomposition due to composting: Phase 2, Final report.** Griest, W.H.; Tyndall, R.L.; Stewart, A.J.; Ho, C.H.; Ironside, K.S.; Caton, J.E.; Caldwell, W.M.; Tan, E. Oak Ridge National Lab., TN (United States). 1 Nov 1991. 141p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92013304. Source: OSTI; NTIS; GPO Dep.

Static pile and mechanically stirred composts generated at the Umatilla Army Depot Activity in a field composting optimization study were chemically and toxicologically characterized to provide data for the evaluation of composting efficiency to decontaminate and detoxify explosives-contaminated soil. Characterization included determination of explosives and 2,4,6,-trinitrotoluene metabolites in composts and their EPA Synthetic Precipitation Leaching Procedure Leachates, leachate toxicity to Ceriodaphnia Dubia and mutagenicity of the leachates and organic solvent extracts of the composts to Ames bacterial strains TA-98 and TA-100. The main conclusion from this study is that composting can effectively reduce the concentrations of explosives and bacterial mutagenicity in explosives – contaminated soil, and can reduce the aquatic toxicity of leachable compounds. Small levels of explosive and metabolites, bacterial mutagenicity, and leachable aquatic toxicity remain after composting. The ultimate fate of the biotransformed explosives, and the source(s) of residual toxicity and mutagenicity remain unknown.

19937 (ORO–2412-110) **Direct effects of energy-related air pollutants on plant sexual reproduction: Final report, February 1, 1979–January 31, 1982.** Ragsdale, H.L.; Murdy, W.H. Emory Univ., Atlanta, GA (United States). 8 Dec 1987. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS05-76EV02412. Order Number DE92011569. Source: OSTI; NTIS; GPO Dep.

Our completed research program concentrated on the direct in vivo effects of energy-related air pollutants on plant sexual reproduction. Direct air pollution effects on plant sexual reproduction have been studied for SO_2 and NO_2, two of the three major air pollutants.

19938 (WSRC-OS–89-94-2) **F/H Area ETF effluent (H-016 outfall) ceriodaphnia survival/reproduction test, test date: September 21, 1989.** Specht, W.L. Westinghouse Savannah River Co., Aiken, SC (United States). Aug 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011373. Source: OSTI; NTIS; GPO Dep.

This toxicity test was conducted to determine if the effluent from the F/H area of Savannah River Plant causes death (acute toxicity) or reduction in the reproduction of the test organisms (chronic toxicity) during a seven day period. A series of dilutions of the effluent are set to determine how much the effluent must be diluted before toxic effects are no longer noted. Acute toxicity is checked by statistically analyzing whether significantly more organisms die in the effluent dilutions than in the control treatment, and, if significantly more die, how much the effluent must be diluted so as to kill only 50% of the test organisms (the LC50). Chronic toxicity is checked by statistically analyzing whether significantly fewer young are produced by test organisms exposed to the effluent dilutions. Results indicate the lowest effluent concentration which shows a toxic effect (the LOEC) and the highest effluent concentration which does not demonstrate an effect (NOEC). Results are discussed.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 18726, 19397

19939 (ETDE-IT–92-23) **Noise control solutions in working environments: Data bank.** Benedetto, G.; Chiattella, A.; Guglielmone, C. Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin (Italy). 1990. 7p. (In Italian). (CONF-9011285–1: Rumore e vibrazioni: valutazione, prevenzione e bonifica, Bologna (Italy), 20-21 Nov 1990). Order Number DE92506240. Source: OSTI; NTIS (US Sales Only).

This paper outlines the planning, by the Galileo Ferraris National Electrotechnical Institute of Italy, of an international noise control data bank which is intended to provide homogeneous and reliable information to assist researchers and designers in optimizing noise control measures to be implemented in the industrial and agricultural working environments. The compiled information is to be grouped into three categories - data on interventions regarding modifications to noise producing equipment, the sound-proofing of the equipment and working environment, protection of equipment operators through their donning of safety gear and modifications to the work routine. The data bank outline includes descriptions of noise control data sources and elaboration methods, as well as, descriptions of the required management software.

57 HEALTH AND SAFETY

Refer also to citation(s) 18623, 19362, 19939, 20550

19940 (DOE/EH–231-006/0891) **Health assessments and other activities of the Agency for Toxic Substances and Disease Registry: RCRA/CERCLA Information Brief.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Aug 1991. 2p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Short communication. HAZARDOUS MATERIALS/evaluation; PUBLIC HEALTH; EVALUATION; EPIDEMIOLOGY; US DOE; US SUPERFUND; REGULATIONS

5701 Real Accidents

Refer also to citation(s) 18311, 18312, 19417

58 GEOSCIENCES

Refer also to citation(s) 17829, 17877, 18008, 18011, 18023, 18033, 18054, 18055, 18061, 18064, 18071, 18103, 18104, 18218, 18256, 18257, 18481, 18482, 18483, 18484, 18485, 18486, 18630, 18767, 18958, 18988, 19017, 19018, 19400, 19401, 19403, 19404, 19407, 19455, 19460, 19469, 19470, 19472, 19497, 19498, 19499, 19518, 19519, 19520, 19521, 19522, 19523, 19533, 19545, 19546, 19549, 19554, 19555, 20294

19941 (CONF-920761–8) **The effects of dissolved salts on oxygen and hydrogen isotope fractionation between water vapor and brines at 50–100°C.** Horita, J.; Wesolowski, D.J.; Cole, D.R. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992. Order Number DE92010432. Source: OSTI; NTIS; GPO Dep.

A series of vapor-liquid water equilibration experiments were carried out in order to determine the effects of dissolved salts (NaCl, KCl, $MgCl_2$, $CaCl_2$, $MgSO_4$, Na_2SO_4, and their mixtures) on oxygen and hydrogen isotope activity ratios in brines at 50–100°C. NaCl, KCl and Na_2SO_4 have little or no effect on oxygen isotope activity ratios. However, oxygen isotope activity ratios in $CaCl_2$,

$MgCl_2$, and $MgSO_4$ solutions are significantly lower than their concentration ratios. In all of the salt solutions studied, hydrogen isotope activity ratios are appreciably higher than their concentration ratios. The isotope effects are all linear with the molalities of the solutions. Mixed salt solutions, including those mimicking natural brines, exhibit the isotope effects additive of those of individual salts. The isotope salt effects observed in this study have profound implications to isotope geochemistry.

19942 (CSNSM-T–88-01) **Study of the geochemistry of the cosmogenic isotope ^{10}Be and the stable isotope ^{9}Be in oceanic environment. Application to marine sediment dating.** Bourles, D. Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse. Jan 1988. 227p. (In French). Order Number DE92517879. Source: OSTI; NTIS (US Sales Only); INIS.

The radioisotope ^{10}Be is formed by spallation reactions in the atmosphere. It is transferred to the oceans in soluble form by precipitation and dry deposition. The stable isotope ^{9}Be comes from erosion of soils and rocks in the Earth's crust. It is transported by wind and rivers and introduced to the oceans probably in both soluble and insoluble form. ^{9}Be was measured by atomic absorption spectrometry and ^{10}Be by A.M.S. The distribution of ^{10}Be and ^{9}Be between each phase extracted and the ^{10}Be/^{9}Be ratios associated were studied in recent marine sediments from Atlantic, Pacific, Indian oceans and Mediterranean sea. The results show that for beryllium the two essential constituent phases of marine sediments are: - the authigenic phase incorporates the soluble beryllium and the detritic phase. The ^{10}Be/^{9}Be ratio associated with the authigenic fraction varies with location. This suggests that the residence time of beryllium in the soluble phase is lower or comparable to the mixing time of the oceans. The evolution with time of the authigenic ^{10}Be/^{9}Be ratio is discussed.

19943 (DOE/ER/14049–T1) **[Energy related studies utilizing microline thermochronology]: Progress report, 1990–1991.** California Univ., Los Angeles, CA (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER14049. Order Number DE92012239. Source: OSTI; NTIS; GPO Dep.

In our first year of the current funding cycle, we have investigated three interrelated aspects of K-feldspar thermochronology; (1) the Ar diffusion properties and microstructures of K-feldspars, (2) the thermal evolution of the Valles Caldera and (3) the continued development of microanalysis. Results of TEM and light microscopy on heated and unheated samples of MH-10 K-feldspar reveal three classes of substructure are present: (1) cross hatched extinction is common and there is almost no albite/pericline twinning, only tweed microstructure; (2) 5–10 vol. % of this K-feldspar are turbid zones with complex twin and tweed structures at the sub-micron scale and numerous dislocation and strain features; (3) about 20% of the K-feldspar is comprised of 0.01 x 0.2-1μm albite exsolution lamellae. The network of fractured/turbid zones divides the sample into blocks of approximately 50 μm and the separation between albite exsolution lamellae produce K-feldspar domains of the order 0.1 μm. Independent crushing and diffusion experiments suggest the scale of the largest domain is order ten's of micron whereas the smallest domain size is inferred to be ~0.1 μm. Many, and perhaps most, alkali feldspars contain diffusion domains with activation energies that may vary by as much as 8 kcal/mol. An extraordinary consequence of even relatively small variations in activation energy between domains is that the shape of an age spectrum can change dramatically by varying the laboratory heating schedule. We have performed ^{40}Ar/^{39}Ar age spectrum experiments on K-feldspar separated from Proterozoic quartz monzonite taken from a depth of 1.76 km down the VC-2B drill hole, Valles Caldera, north-central New Mexcio.

19944 (DOE/ER/14194–1) **Poroelasticity of rock: Progress report.** Wang, H.F. Wisconsin Univ., Madison, WI (United States). Dept. of Geology and Geophysics. Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER14194. Order Number DE92012315. Source: OSTI; NTIS; GPO Dep.

The research program is an experimental study of static and dynamic poroelastic behavior of rocks. Measurements of Skempton's coefficient and undrained Poisson's ratio together with drained bulk modulus and shear modulus will provide a complete set of the four poroelastic moduli. Stress coupling to fluid flow in fractured rock can occur also through changes of fracture permeability due to fracture compressibility. Numerical models that include this effect will be compared with standard double porosity models of fluid extraction from oil reservoirs. Wave velocity and attenuation measurements will be made from seismic to ultrasonic frequencies to establish a phenomenological model of the effects of permeability, porosity and saturation for seismic exploration of oil and gas and for seismic characterization of an aquifer for environmental restoration and waste remediation.

19945 (DOE/ER/60319–T1) **[Support of the board on ocean science and policy].** National Research Council, Washington, DC (United States). Commission on Physical Sciences, Mathematics, and Resources. [1987]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-85ER60319. Order Number DE92011419. Source: OSTI; NTIS; GPO Dep.

The National Academy of Sciences, through the Ocean Studies Board of the Commission on Physical Sciences, Mathematics and Resources, proposes to provide guidance on major ocean sciences and policy issues to the National Oceanic and Atmospheric Administration, the National Science Foundation, the Department of the Navy, the US Geological Survey, the Minerals Management Service of the Department of the Interior, the US Coast Guard, the Department of State, the Department of Energy, The Environmental Protection Agency, and the National Aeronautics and Space Administration. The work plan for this activity is presented in the program plan section of this proposal. Work plans for subsequent years will be submitted prior to the commencement of work. Financial support is requested for continued support of the Ocean Studies Board activities from 1 June 1987 through 31 May 1989. Funds in the amount of $513,400 are requested for the period 1 June 1987 through 31 May 1988, as indicated in the attached estimate of costs.

19946 (DOE/ER/61013–2) **Mechanisms controlling the production and transport of methane, carbon dioxide, and dissolved solutes within a boreal peatland: Progress report, January 15, 1991–July 14, 1992.** Siegel, D.I. Syracuse Univ., NY (United States). 9 Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61013. Order Number DE92011752. Source: OSTI; NTIS; GPO Dep.

Peatlands are one of the most important terrestrial reservoirs in the global cycle for carbon, and are a major source for atmospheric methane. However, little is known about the dynamics of these carbon reservoirs or their feedback mechanisms with the pool of atmospheric CO_2 during the Holocene. Specifically, it is unknown whether large peat basins are sources, sinks, or steady-state reservoirs for the global carbon cycle. In particular, the production and transport of methane, carbon dioxide, and dissolved organic carbon form the deeper portions of these peatlands is unknown. Our DOE research program is to conduct an integrated ecologic and hydrogeochemical study of the Glacial Lake Agassiz peatlands (northern Minnesota) to better understand the carbon dynamics in globally significant peat basins. Specifically, our study will provide local and regional data on (1), rates of carbon accumulation and loss and fluxes of methane in the peat profiles; (2) the physical and botanical factors controlling the production of methane and carbon dioxide in the wetland; and (3) the role of hydrogeologic processes in controlling the fluxes of gases and solutes through the peat. We intend to use computer simulation models, calibrated to field data, to scale-up from local to regional estimates of methane and carbon dioxide within the basin. How gases and dissolved organic carbon escapes form peatlands in unknown. It has been suggested that the concentrations of methane produced in the upper peat are sufficient to produce diffusion gradients towards the surface. Alternatively, gas may move through the peat profile by groundwater advection.

19947 (DOE/ER/61066–T1) **Parameterization of convective clouds, mesoscale convective systems, and convective-generated cirrus: Year 2 technical progress report, September 15, 1991–September 14, 1992.** Cotton, W.R. Colorado State

Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science. 3 Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61066. Order Number DE92010951. Source: OSTI; NTIS; GPO Dep.

A level 2.5w deep convection updraft/downdraft parameterization scheme has been refined and tested against 3D simulations of sea-breeze generated convection over S. Florida. Cases for explicit simulation of MCSs in mid-latitudes and tropics have been encouraging. After a few refinements in those cases, fine resolution explicit simualtions of deep convection and mesoscale, stratiform clouds will be begun.

19948 (DOE/ER/61202-1) **Steady-state and transient modeling of tracer and nutrient distributions in the global ocean: Progress report, June 1, 1991–March 31, 1992.** Stocker, T.F.; Broecker, W.S. Columbia Univ., Palisades, NY (United States). Lamont-Doherty Geological Observatory. 26 Mar 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61202. Order Number DE92011805. Source: OSTI; NTIS; GPO Dep.

The deep circulation model developed by Wright and Stocker has been used to represent the latitude-depth distributions of temperature, salinity, radiocarbon and "color" tracers in the Pacific, Atlantic and Indian Oceans. Restoring temperature and salinity to observed surface data the model shows a global thermohaline circulation where deep water is formed in the North Atlantic and in the Southern Ocean. A parameter study reveals that the high-latitude surface salinity determines the composition of deep water and its flow in the global ocean. Increasing Southern Ocean surface salinity by 0.4 ppt the circulation changes from a present-day mode where North Atlantic Deep Water is one where Antarctic Bottom Water is dominant. An inorganic carbon cycle with surface carbonate chemistry is included, and gas exchange is parameterized in terms of pCO_2 differences. Pre- industrial conditions are achieved by adjusting the basin-mean alkalinity. A classical $2\times CO_2$ experiment yields the intrinsic time scales for carbon uptake of the ocean; they agree with those obtained from simple box models or 3-dimensional ocean general circulation models. Using the estimated industrial anthropogenic input of CO_2 into the atmosphere the model requires, consistent with other model studies, an additional carbon flux to match the observed increase of atmospheric pCO_2. We use more realistic surface boundary conditions which reduce sensitivity to freshwater discharges into the ocean. In a glacial-to-interglacial experiment rapid transitions of the deep circulation between two different states occur in conjunction with a severe reduction of the meridional heat flux and sea surface temperature during peak melting. After the melting the conveyor belt circulation restarts.

19949 (NEI-NO-215) **A study of fluid-rock interactions during metamorphism.** Jamtveit, B. Oslo Univ. (Norway). Inst. for Geologi. 1990 120p. Order Number DE92506559. Source: OSTI; NTIS (US Sales Only).

This thesis comprises three papers: Fluid controlled eclogitization of granulites in deep crustal shear zones, Bergen Arcs, western Norway; Contact metamorphism of layered metasediments in the Oslo rift: Buffering, infiltration and the mechanisms of mass transport; Oscillatory zonation patterns in hydrothermal grossular - andradite garnets: Nonlinear behavior in regions of immiscibility. Each paper covers aspects of fluid-rock interactions during metamorphisms. The two first papers mainly focus on fluid controlled transport. The last paper discusses how the dynamics of a small system, a growing garnet, may be affected by external forcings controlled by large-scale fluid flow. 159 refs., 27 figs., 8 tabs.

19950 (NUREG/CR-5731) **Piedmont seismic reflection study: A program integrated with tectonics to probe the cause of eastern seismicity.** Glover, L. III (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Geological Sciences); Coruh, C.; Costain, J.K.; Bollinger, G.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Geological Sciences. Mar 1992. 128p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

A new tectonic model of the Appalachian orogen indicates that one, not two or more, terrane boundaries is present in the Piedmont and Blue Ridge of the central and southern Appalachians. This terrane boundary is the Taconic suture, it has been transported in the allochthonous Blue Ridge/Piedmont crystalline thrust nappe, and it is repeated at the surface by faulting and folding associated with later Paleozoic orogenies. The suture passes through the lower crust and lithosphere somewhere east of Richmond. It is spatially associated with seismicity in the central Virginia seismic zone, but is not conformable with earthquake focal planes and appears to have little causal relation to their localization.

19951 (UCRL-JC-104837) **Supercomputing and nonlinear seismic structural response of freeway structures.** Goudreau, G.L.; Kay, G.; McCallen, D.; Schauer, D.; Logan, R. Lawrence Livermore National Lab., CA (United States). Nov 1990. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9104355-1: 1991 American Society of Civil Engineers (ASCE) structures congress, Indianapolis, IN (United States), 29 Apr - 1 may 1991). Order Number DE92011460. Source: OSTI; NTIS; GPO Dep.

The Loma Prieta earthquake stimulated a major reassessment of Bay Area structures to consider much larger earthquakes than originally designed for. The supercomputers of the Lawrence Livermore National Laboratory were used to demonstrate the feasibility of nonlinear structural time history analysis to assess likelihood of failure of critical structures.

19952 (UCRL-JC-108315) **Statistical model for rock fracture.** Blair, S.C. (Lawrence Livermore National Lab., CA (United States)); Cook, N.G.W. Lawrence Livermore National Lab., CA (United States). 15 Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920634-11: 33. US symposium on rock mechanics, Santa Fe, NM (United States), 8-10 Jun 1992). Order Number DE92011527. Source: OSTI; NTIS; GPO Dep.

The mechanical behavior of rock in compression and at conditions appropriate to brittle behavior is controlled by the growth and coalescence of microcracks. This process depends on the disorder in the rock's microstructure due to the natural heterogeneity inherent in rocks. We are developing a statistical model that can incorporate microstructural heterogeneity for the study of fracture in rock and other heterogeneous materials. Our model uses (1) fracture-mechanics analysis to determine crack growth at a microstructural (grain) scale, (2) the concept of nearest-neighbor interaction, and (3) the techniques of percolation theory and self-organized criticality to evaluate crack interaction and coalescence, and the formation of fractures. The model is in the initial stages of development and this paper will describe the results of work in progress.

19953 (UCRL-JC-109501) **Intercomparison of global marine climatologies.** Grotch, S.L. Lawrence Livermore National Lab., CA (United States). Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9201100-1: International comprehensive ocean atmosphere data set (COADS) workshop, Boulder, CO (United States), 13-15 Jan 1992). Order Number DE92011389. Source: OSTI; NTIS; GPO Dep.

One of the major goals of the Program for Climate Model Diagnosis and Intercomparison at LLNL is the development and application of statistical/graphical methods for the intercomparison of GCMs among themselves and with observational data. Consequently, it is important to have available datasets that represent "current climate" and a range of tools with which to perform detailed intercomparisons. This work reports on an intercomparison of four historical climatologies for surface winds (focusing on zonal u-wind) and illustrates a variety of statistical/graphical tools that can be used to quantitatively determine the differences/similarities among these datasets.

19954 (USGS-OFR-91-105) **Aeromagnetic map of the Beatty quadrangle, Nevada-California.** Glen, J.M.; Ponce, D.A. Geological Survey, Menlo Park, CA (United States). 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-78ET44802. Source: OSTI; INIS; US Geological

Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225-0425.

An aeromagnetic map of the Beatty Quadrangle, Nevada-California has been prepared from six separate aeromagnetic surveys. This report contains the map. (JL)

66 PHYSICS

6610 General Physics

19955 (SLAC-PUB-5732) **On the measuremnt of π.** Noyes, H.P. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Feb 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9109360-1: 13. annual internationial meeting of the Alternative Natural Philosophy Association (ANPA), Cambridge (United Kingdom), 12-15 Sep 1991). Order Number DE92011582. Source: OSTI; NTIS; GPO Dep.

Inspired by Stillman Drake's definition of Galilean Units as those for which $[L/T^2 = (\pi^2/8)g]$ where g is any finite, constant acceleration measured in units of L and T, we construct a kinematical dimensional analysis based only on two universal, dimensionless constants. For the linear relation between L and T we use Einsteinian Units $L/= (1)c$. For orbiting masses negligible compared to some mass unit M, we use Keplerian Units based on his second law $[L^2/T = (1/2\pi)h/M]$. Then the unit for orbital angular momentum is $\hbar$, independent of the mass scale. This allows us to define dimensionless coupling constants $f^2 = \beta = v/c$ where v is the orbital velocity. We find that most of relativistic quantum mechanics requires only kinematical units. Dynamical units require a mass scale with universal significance, set by the orbital velocity $v = c$ (or $f^2 = 1$). In dimensional form this becomes $M = (1)[\hbar c/G]^{1/2}$. Assuming baryon number conservation, the fact that the proton is the lightest stable baryon allows us to calculate $\hbar c/Gm_p{}^2 \approx 1.7 \times 10^{38}$ as the Beckenstein number of the proton–the number of bits of information lost in its formation–and connects our units to the elementary particle mass scale.

6611 Classical and Quantum Mechanics

Refer also to citation(s) 19188, 19985, 20194, 20563, 20609

19956 (BONN-HE-92-04) **The energy operator for infinite statistics.** Stanciu, S. Bonn Univ. (Germany). Physikalisches Inst. Feb 1992. 9p. Order Number DE92517007. Source: OSTI; NTIS (US Sales Only); INIS.

We construct the energy operator for particles obeying infinite statistics defined by a q-deformation of the Heisenberg algebra. (orig.).

19957 (INIS-mf-13192, pp. 43-44) **Dissipation of energy studied on the quantum mechanical models.** Marvan, M. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

What is the minimum energy dissipated per one step of logic operation? In the discussion, the device working on principles of irreversible logic was used. The dissipated energy was determined for two cases. As the first example a capacitor was discussed the charged and discharged states of which represents state 1 and 0, respectively. As the second example model was studied in which the logical states are represented by atoms sitting in the two potential minima of a potential double barrier. The results of determining the dissipated energy show that the relation (Landauer, R., IBM J. Res. Develop. 5, 183(1961)) which is very often cited, is not true for the quantum mechanical model. (Z.S.). 6 refs.

19958 (INIS-mf-13192, pp. 63-64) **Anharmonic oscillators and continued fractions.** Znojil, M. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

If attempts to describe, e.g., the low-lying spectrum of excitations of a molecule or a system of nucleons by means of a model which can be solved exactly (such as the harmonic oscillator) fail, perturbation theory can be tried. The anharmonic oscillator and the Rayleigh-Schroedinger perturbation series for energies are typical examples. Perturbation theory, however, fails as well if the bond constants are high. In practice, the Pade approximants method is convenient. Formulas in the form of infinite continued fractions are a particular case of this approach. (Z.S.). 8 refs.

19959 (INIS-mf-13192, pp. 69-72) **History of basic experiments with particle diffraction and interference.** Komrska, J. (Ceskoslovenska Akademie Ved, Brno (Czechoslovakia). Ustav Pristrovoje Techniky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A brief overview is presented of some basic experiments in the field of diffraction and interference of particles. It begins with electron microscopy, which enabled fundamental diffraction experiments with electrons to be performed. A prominent scientist dealing with this topic was Hans Boersch. In the early 1930's, Boersch made some projection electron microscopy studies that enabled him to observe Fresnel's diffraction effects, particularly on impermeable half-planes. Fresnel's zonal structure played an important part in the development of wave theory. Truly fundamental to wave theory, however, was Young's experiment, which was concerned with Fresnel's diffraction on two holes (slits). This experiment with electrons was carried out many times in the form of diffraction on two circular holes. (Z.S.). 3 figs., 11 refs.

19960 (INIS-mf-13192, pp. 242) **Extended model for quantum mechanics.** Lokajicek, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Kundrat, V. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUANTUM MECHANICS/ hilbert space; IMPACT PARAMETER

19961 (INIS-mf-13194, pp. 264-270) **Systematic approach to conserved quantities.** Moebius, P. (Technische Univ., Dresden (Germany). Sektion Physik). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475-: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

An essential constituent of integrable systems of Hamiltonian classical mechanics is the existence of a sufficient number of conserved quantities. The problem is to calculate them explicitly. A calculation procedure is presented for the integrable many-particle problem, where the starting point is not the corresponding Hamiltonian but a certain (fxf) matrix, where f is the finite number of degrees of freedom. The conserved quantities appear then as invariants of this matrix which can be obtained in a straightforward way. (Z.S.) 4 refs.

19962 (INIS-mf-13194, pp. 350-354) **1/N-expansion and determination of resonance parameters in quantum mechanics.** Mur, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Popov, V.S.; Weinberg, V.M. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Suggestions have been made to treat the number of colors N_c in QCD as a large parameter and to use a $1/N_c$-expansion. A large number of degrees of freedom leads to the classical limit and simplifies the dynamics. This is true in the quantum mechanical problem as well; here in analogy to N_c the large parameter is $M=l+D/2$ (l is the angular momentum and D the number of space dimensions). The development of the 1/n-expansion of N is presented. In addition to the analogy with $1/N_c$, this expansion has useful applications in atomic physics and allows to compute the energy and width of resonances explicitly, including the strong coupling region. (Z.S.) 2 figs., 12 refs.

19963 (ITF–89-44) **Nonlocal boundary condition and zero modes of the Dirac operator on two-dimensional surface in magnetic field.** Mishchenko, A.V.; Sitenko, Yu.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 21p. (In Russian). Order Number DE92627159. Source: OSTI; NTIS (US Sales Only); INIS.

Zero modes of the two-dimensional Dirac operator on compact and noncompact surfaces in an external static magnetic field are considered. For zero modes on a compact surface with boundary the nonlocal boundary condition which is equivalent to the square integrability condition for zero modes on a noncompact surface is performed. 16 refs.

19964 (ITP–89-43) **Quasi-Hopf algebras and Knizhnik-Zamolodchikov equations.** Drinfel'd, V.G. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 16p. Order Number DE92627160. Source: OSTI; NTIS (US Sales Only); INIS.

The paper is a brief exposition of Drinfeld work. The notion of quasitriangular Hopf algebra is remained. The notion of quasitriangular quasi-Hopf algebra is introduced. A class of quasitriangular quasi-Hopf algebras using the differential equations for n-point functions in the WZW theory is constructed. Within the perturbation theory with respect to Planck's constant essentially all quasitriangular quasi-Hopf algebras belong to this class is asserted. A natural proof of Kohno's theorem on the equivalence of two kinds of braid group representations is given. Applications to knot invariants and the classical limit of various quantum notions are discussed. 16 refs.

19965 (KIYal–89-25) **Cross section simulation and determination of the average resonance parameters from experiments of transmission for filtered neutrons.** Novoselov, G.M.; Litvinskij, L.L.; Murzin, A.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1989. 19p. (In Russian). Order Number DE92627161. Source: OSTI; NTIS (US Sales Only); INIS.

A method of neutron cross section simulation on unresolved resonance region and its application for determination of nuclear average resonance parameters from transmission data on filtered neutrons are described. 15 refs.; 1 fig.

19966 (KIYal–89-30) **About one possibility of average neutron width estimation in unresolved resonance energy region.** Basenko, V.K.; Litvinskij, L.L.; Prokopets, G.A.; Purtov, O.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1989. 14p. (In Russian). Order Number DE92627162. Source: OSTI; NTIS (US Sales Only); INIS.

The method of experimental study of total cross-sections resonance structure in unresolved energy region is described. Proposed method is based on the measuring of transmissions by samples of neutrons, scattered by another sample of the same material on various angles. The results of model experiments and approciable experiment on Co-59 and filtered reactor neutron beam are presented. 3 refs.; 10 figs.

19967 (SLAC-PUB–5752) **The RQM triangle: A paradigm for relativistic quantum mechanics.** Noyes, H.P. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9202100–1: 8. annual Western regional meeting of the Alternative Natural Philosophy Association (ANPA), Stanford, CA (United States), 15-17 Feb 1992). Order Number DE92011583. Source: OSTI; NTIS; INIS; GPO Dep.

A simple way to relate Lorentz transformations to a finite and discrete model of counter firings is presented. We first abstract from counter firings with finite resolution to rational fraction velocities and a finite step-length. Discrete Lorentz transformations and quantized rotations follow. These are encoded by three integers and a triangle with integer sides: the RQM Triangle. The double slit experiment allows us to observe quantized space steps and measure invariant step lengths for any particle in rational ratio to one such length for any convenient reference particle. A discrete version of the Mandelstam analysis of elastic and anelastic scattering is implied. The results fit naturally into the bit-string formalism used in earlier work.

6612 Techniques of General Use in Physics

Refer also to citation(s) 18726

19968 (ETDE-IT–92-24) **Magnesium atomic beam frequency standard with optical pumping.** Godone, A. Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin (Italy). 1990. 10p. (In Italian). (CONF-9009490–: Prospettive delle misure elettriche ed elettroniche, Padua (Italy), 20-22 Sep 1990). Order Number DE92506286. Source: OSTI; NTIS (US Sales Only); INIS.

Optical pumping of the metastable states of magnesium was conducted in a thermal atomic beam with the use of coherent radiation in P3(3s3p)-S3(3s4s) visible transition resonance. The application of this technique allowed the experimental demonstration of the possibility of immediately increasing the short term stability of the sample by one order of size and then by two orders of size in a subsequent phase. This appears to suggest the feasibility of a magnesium 24 frequency sample with which an accuracy comparable with that of cesium 133 can be obtained and whose stability approaches that of maser-H.

19969 (KIYal–89-22) **On production and acceleration of polarized heavy ions at tandem electrostatic accelerator (TEA).** Aushev, V.E.; Zaika, N.I.; Magal', M.I.; Totskij, Yu.I.; Khudenko, A.Ya. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1989. 19p. (In Russian). Order Number DE92627209. Source: OSTI; NTIS (US Sales Only); INIS.

The possibilities of polarized experiments with heavy ions on TEA at terminal voltage 7.5MV are discussed. The scheme of polarized ion source (PIS) of ^{14}N and its injection into the accelerator is described. The data energies at accelerator output and target nucleus maximum charges for nuclear reactions of above Coulomb barrier were obtained. The optics of ion movement from PIS to the target and spin dynamics calculation results of ^{14}N ions moving in the same channel on axial and the most remote side trajectory is analyzed. The most suitable variants of transportation and acceleration of polarized heavy ions for providing the measurement optimal conditions in target were determined. 12 refs.; 3 figs.; 3 tabs.

6613 Other Aspects of Physical Science

Refer also to citation(s) 18571, 18723, 18905, 19130, 19181, 19188, 19323, 19343, 19349, 19388, 19524, 19967, 19993, 20024, 20025, 20193, 20353, 20434

19970 (CONF-8912170–1) **A finite element solver for the Maxwell equations.** Loehner, R. (George Washington Univ., Washington, DC (United States)); Ambrosiano, J. Lawrence Livermore National Lab., CA (United States). [1989]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From GAMNI-SMAI conference on numerical methods for the Maxwell equations; Paris (France); Dec 1989. Order Number DE92012187. Source: OSTI; NTIS; GPO Dep.

We present several solvers for the Maxwell equations based on unstructured grids. Numerical experiments, intended to quantify the performance of these schemes, reveal that they are very accurate. Grid adaptation in the form of remeshing is applied to radar cross-section problems, and found to be a very effective tool.

19971 (DOE/ER/14176–T1) **Knot invariants and the thermodynamics of lattice gas automata: Technical progress report, 15 May 1991–14 April 1992.** Meyer, D.A. California Univ., San Diego, La Jolla, CA (United States). Inst. of Pure and Applied Physical Sciences. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-91ER14176. Order Number DE92011853. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this project is to build on the understanding of the connections between knot invariants, exactly solvable statistical mechanics models and discrete dynamical systems that we have gained in earlier work, toward an answer to the question of how early and robust thermodynamic behavior appears in lattice gas automata.

19972 (LA-UR–92-296) **Wavenumbers for currents on infinite- and finite-length wires in a chiral medium.** Bhattacharyya, A.K. (New Mexico State Univ., Las Cruces, NM (United States)); Burke, G.J.; Miller, E.K. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920750–2: Institute of Electrical and Electronic Engineers-American Physical Society (IEEE-APS) international symposium, Chicago, IL (United States), 18-25 Jul 1992). Order Number DE92007565. Source: OSTI; NTIS; GPO Dep.

There is increasing interest in determining the electromagnetic properties of material media differing from free space and the effects thereof on the radiation, propagation, and scattering of electromagnetic fields. A material property of special present interest is that of chirality. Chirality manifests itself as a "handedness" wherein a chiral medium does not support propagation of a linearly-polarized plane wave, but which instead decomposes into two circularly-polarized waves that propagate at different speeds. Initial work in this area was devoted to developing various analytical solutions to some basic problems such as the Green's Dyadic for a point current source. Attention is now being increasingly devoted to using this early work for a variety of applications such as analyzing antennas in chiral media scattering from chiral objects; scattering from objects having chiral coatings; and reflection from planar chiral interfaces. The focus of the work described here is determining the wavenumbers $(=-\alpha-j\beta)$ of the current waves excited on wire antennas located in an infinite chiral medium using two complementary approaches. One is to use an extension of an existing computer model (NEC) that permits modeling of arbitrary wire objects located in an infinite chiral medium. The other is to develop a solution for an infinitely long cylindrical antenna also located in an infinite chiral medium. The latter canonical problem is of interest in its own right as well as providing a means for achieving mutual validation with the NEC model. 9 refs.

19973 (LA-UR–92-845) **A linear and nonlinear study of Mira.** Cox, A.N. (Los Alamos National Lab., NM (United States)); Ostlie, D.A. Los Alamos National Lab., NM (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9107218–1: International Astronomical Union (IAU) conference on nonlinear phenomena in stellar variability, Buenos Aires (Argentina), 23 Jul - 1 aug 1991). Order Number DE92011265. Source: OSTI; NTIS; GPO Dep.

Both linear and nonlinear calculations of the 331 day, long period variable star Mira have been undertaken to see what radial pulsation mode is naturally selected. Models are similar to those considered in the linear nonadiabatic stellar pulsation study of Ostlie and Cox. Models are considered with masses near one solar mass, luminosities between 4000 and 5000 solar luminosities, and effective temperatures of approximately 3000 K. These models have fundamental mode periods that closely match the pulsation period of Mira. The equation of state for the stellar material is given by Stellingwerf procedure, and the opacity is obtained from a fit by Cahn that matches the low temperature molecular absorption data for the Population I Ross-Aller 1 mixture calculated from the Los Alamos Astrophysical Opacity Library. For the linear study, the Cox, Brownlee, and Eilers approximation is used for the linear theory variation of the convection luminosity. For the nonlinear work, the method described by Ostlie and Cox is followed. Results showing internal details of the radial fundamental and first overtone modes behavior in linear theory are presented. Preliminary radial fundamental mode nonlinear calculations are discussed. The very tentative conclusion is that neither the fundamental or first overtone mode is excluded from being the actual observed one.

19974 (LA-UR–92-861) **Radial and nonradial periods and growth rates of an AI Velorum model.** Guzik, J.A. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920184–3: International Astronomical Union (IAU) meeting, Mito (Japan), 6-10 Jan 1992). Order Number DE92011369. Source: OSTI; NTIS; GPO Dep.

Walraven, Walraven, and Balona recently discovered several new periodicities in addition to the well-known fundamental and first overtone periods of the high-amplitude δ Scuti star AI Velorum. Linear nonadiabatic pulsation calculations were performed for an AI Velorum model of mass 1.96 $M_{\odot}$, 24.05 $L_{\odot}$, and T_{eff}7566 K for the radial and low-degree nonradial modes to help verify the tentative identifications made by Walraven, et al. Comparison of the calculated periods with the observations suggests some alternatives to the identifications proposed by Walraven, et al.

19975 (LA-UR–92-879) **Nonlinear RR Lyrae models with new Livermore opacities.** Guzik, J.A.; Cox, A.N. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920184–2: International Astronomical Union (IAU) meeting, Mito (Japan), 6-10 Jan 1992). Order Number DE92011158. Source: OSTI; NTIS; GPO Dep.

A.N. Cox recently showed that a 20% opacity decrease in the 20,000–30,000 K region as indicated by the new Livermore OPAL opacities reconciles the discrepancy between pulsation and evolution masses of double-mode RR Lyrae variables. Nonlinear hydrodynamic calculations were performed for RR Lyrae models of mass 0175 M$\odot$, 51 L$\odot$, and $Z=0.0001$ including this opacity decrease. The Stellingwerf periodic relaxation method was used to converge the models to a limit cycle, and the Floquet matrix eigenvalues calculated to search for a tendency of the fundamental mode to grow from the full-amplitude overtone solution, and the overtone mode to grow from the full-amplitude fundamental solution, thereby predicting double-mode behavior. Models of $T^{eff} < 7000$ K with the opacity decrease have positive fundamental-mode growth rates in the overtone solution, in contrast to earlier results by Hodson and Cox, and models with $T_{eff} < 7000$ have positive 1st overtone growth rates in the fundamental-mode behavior was not found.

19976 (SAND–91-2910C) **Modeling arbitrarily directed slots that are narrow both in width and depth with regard to the FDTD spatial cell.** Riley, D.J.; Turner, C.D. Sandia National Labs., Albuquerque, NM (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920750–3: Institute of Electrical and Electronic Engineers-American Physical Society (IEEE-APS) international symposium, Chicago, IL (United States), 18-25 Jul 1992). Order Number DE92008015. Source: OSTI; NTIS; GPO Dep.

The Hybrid Thin-Slot Algorithm (HTSA) integrates a transient integral-equation solution for an aperture in an infinite plane into a finite-difference time-domain (FDTD) code. The technique was introduced for linear apertures and was extended to include wall loss and lossy internal gaskets. A general implementation for arbitrary thin slots is briefly described here. The 3-D FDTD-code TSAR was selected for the implementation. The HTSA does not provide universal solutions to the narrow slot problem, but has merits appropriate for particular applications. The HTSA is restricted to planar slots, but can solve the important case that both the width and depth of the slot are narrow compared to the FDTD spatial cell. IN addition, the HTSA is not bound to the FDTD discrete spatial and time increments, and therefore, high-resolution solutions for the slot physics are possible. The implementation of the HTSA into TSAR is based upon a "slot data file" that includes the cell indices where the desired slots are exist within the FDTD mesh. For an HTSA-defined slot, the wall region local to the slot is shorted, and therefore, to change the slot's topology simply requires altering the file to include the desired cells. 7 refs.

19977 (SAND–92-0390C) **Massively parallel solutions for the modeling of complex electromagnetic systems.** King, A.S.;

Lee, C.E. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9206139–1: C31 technology and applications, Rome, NY (United States), 1-4 Jun 1992). Order Number DE92010959. Source: OSTI; NTIS; GPO Dep.

Many applications of national importance require the design, analysis, and simulation of complex electromagnetic phenomena. These applications range from the simulation of synthetic aperture radar to the design and analysis of low-observable platforms, antenna design, and automatic target recognition. In general, the modeling of complex electromagnetic phenomena requires significant amounts of computer time and capacity on conventional vector supercomputers but takes far less on massively parallel computers. Sandia National Laboratories is currently developing massively parallel methods and algorithms for the characterization of complex electromagnetic phenomena. The goal of on going research at Sandia is to understand the characteristics, limitations, and trade-offs associated with complex electromagnetic systems including: modeling the seeker response to complex targets in clutter, calculating the radiation and scattering from conformal communication and radar system antennas, and the analysis and design of high speed circuitry. By understanding the theoretical underpinnings of complex electromagnetic systems it is possible to achieve realistic models of system performance. The first objective is the development of computationally practical, high fidelity, systems models targeted for massively parallel computers. Research to achieve this objective is conducted in such areas as mathematical algorithms, problem decomposition, inter-processor communication schemes, and load balancing. The work in mathematical algorithms includes both the development of new methods and the parallel implementation of existing techniques. The second objective is the application of these high fidelity models to facilitate a better understanding of systems level performance for many C^3I platforms. This presentation describes applications of much current interest and novel solution techniques for these applications utilizing massively parallel processing techniques.

19978 (TRITA-EPP–91-03) **A numerical model of ionospheric convection derived from field-aligned currents and the corresponding conductivity.** Blomberg, L.G.; Marklund, G.T. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics. Aug 1991. 31p. Order Number DE92627927. Source: OSTI; NTIS (US Sales Only); INIS.

Supersedes TRITA-EPP–88-03.

A numerical model for the calculation of ionospheric convection patterns from given distributions of field-aligned current and ionospheric conductivity is described. The model includes a coupling between the conductivity and the field-aligned current, so that the conductivity peaks in regions of upward current, as is usually observed by measurements. The model is very flexible in that the input distributions, the field-aligned current and the conductivity, have been parametrized in a convenient way. From the primary model output, namely the ionospheric electrostatic potential (or convection) in the corotating frame, a number of other quantities can be computed. These include; the potential in the inertial frame (the transformation takes into account the non-alignment of the Earths magnetic and geographic axes), the potential in the magnetospheric equatorial plane (projected using either a dipole magnetic field model or the Tsyganenko-Usmanov model, and the assumption of either vanishing parallel electric field or a proportionality between parallel potential and upward field-aligned current), the distribution of ionospheric (horizontal) current, and the Joule heating in the ionosphere. This model has been used together with a new snapshot technique to calculate the high-latitude potential distribution prevailing during a particular event by combining information from global auroral images and local measurements of fields and particles. The model potential variation along the satellite orbit was found to be in excellent agreement with that calculated from the measured electric field. The model has also been used to study some fundamental properties of the electrodynamics of the high-latitude ionosphere. The results of these different applications of the model have been published separately. (au) (39 refs.).

19979 (UCRL-CR–110002) **Ionospheric communications channel modelling.** Bahr, R.K. (Arizona Univ., Tucson, AZ (United States). Dept. of Electrical and Computer Engineering); Ward, B.R. Lawrence Livermore National Lab., CA (United States). Feb 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013039. Source: OSTI; NTIS; GPO Dep.

The general scope of this work has been to investigate "Ionospheric Communications Channel Modeling." Specifically, we have developed a simple model to study the detection and time-of-arrival (TOA) estimation of an earth-based, transient electromagnetic pulse by a satellite-borne receiver. The complete channel model divides naturally into four parts: the electromagnetic pulse signal model, the ionospheric propagation mode, the noise model, and the detector/TOA estimator. The model described in this report is admittedly very crude. Numerous simplifications and outright omissions have been made. Nevertheless, we hope that the contents herein will provide a sufficient basis should an interested researcher wish to pursue the study of transient pulse detection and estimation. Below each of the four sub-models is detailed. We alert the reader to some of the simplifications/omissions made in the model development. It will become clear that to produce a highly accurate ionospheric communications channel model is indeed a substantial undertaking. 11 refs.

19980 (UCRL-JC–103243-Rev.2) **Plane stokes flow driven by capillarity on a free surface: Overview and status: Revision 2.** Hopper, R.W. Lawrence Livermore National Lab., CA (United States). 25 Oct 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-900684–1-Rev.2: 5. international colloquium on free boundary problems: theory and applications, Montreal (Canada), 13-22 Jun 1990). Order Number DE92011469. Source: OSTI; NTIS; GPO Dep.

This article summarizes some recent work on the creeping viscous incompressible plane flow in a region, bounded by a simple smooth closed curve and driven solely by surface tension. Such problems are self-contained in that the applied tractions are intrinsic in the geometry. The objective is to determine exactly the time evolution of the shape of the region. The problems are fundamentally nonlinear due to the large changes in shape, and it is emphasized that no mathematical approximations are made. For finite regions, the shape in the complex z-plane is described in terms of a time-dependent conformal mapping function $\Omega(\zeta, t)$ on the fixed region $|\zeta| \leq 1$ of the complex ζ-plane. In practice, it has been necessary to conjecture an explicit parametric form $\Omega[\zeta;\alpha_1(t), \alpha_2(t), \cdots]$ whose validity must be verified using the shape- evolution equation. Suitable parameterizations are not always obvious. When the conjectured form holds and the equations can be solved, the evolution of the shape with time is obtained in simple, exact and closed form except for the value of the time, which requires a mere quadrature. Internal velocity and stress fields can be obtained.

19981 (UCRL-JC–104580) **Localized transmission of acoustic beam energy.** Lewis, D.K. Lawrence Livermore National Lab., CA (United States). Dec 1990. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-901202–2: Ultrasonics symposium, Honolulu, HI (United States), 5-7 Dec 1990). Order Number DE92011522. Source: OSTI; NTIS; GPO Dep.

Recent experiments have shown that it is possible to create a pulsed beam of acoustic energy which maintains amplitude and beam width better than either conventional single frequency or wideband beams of comparable frequency content. This presentation describes work done at LLNL in the design and generation of these localized wave transport beams. The experimental techniques to date have included acousto-optics, two transducer linear superposition and arrays compared to individually addressable elements. The beam width, amplitude and frequency spectra of the localized beams are compared to those of both single frequency tone burst piston beams and wide band Gaussian beams. An overview of the theory will be given and proposed applications discussed.

19982 (UCRL-JC–107443) **Calculational prediction of ultra-wideband electromagnetic pulses by laser-initiated air avalanche switches.** Mayhall, D.J.; Yee, J.H. Lawrence Livermore National Lab., CA (United States). Dec 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920124–21: Society of Photo-Optical

Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92011732. Source: OSTI; NTIS; GPO Dep.

The gas avalanche switch is a recently conceived, laser-activated, high-voltage, picosecond-speed switch. It basically consists of a set of pulse-charged electrodes immersed in a gas at high-pressure (2–800 atm). A picosecond-scale laser pulse initiates an avalanche discharge in the gas between the electrodes. With the proper configuration, the avalanche, which is fueled by the immense number of electrons available in the gas, causes the applied voltage to collapse in picoseconds and generates electromagnetic waves. A two-dimensional electron fluid computer code solves Maxwell's curl equations and a set of electron fluid equations for transverse magnetic modes in air between parallel plane conductors. Collision frequencies for ionization and momentum and energy exchange to neutral molecules are taken to scale directly with neutral pressure. Calculations are performed for a Blumlein pulse generator geometry, featuring a charged rectangular center electrode between grounded parallel plates spaced 2 mm apart. In one mode of operation, initial electrons are induced in the lower air gap, the gap between the center electrode and the lower plate. At 292 kV on the center electrode, 27 atm pressure, and uniform ionization under the full width of the center electrode, induced voltage pulses of 300 kV, 2.4 ps rise time, 9.1 ps full width at half maximum (FWHM), 38 ps duration, and 22 GHz bandwidth at 3 dB occur at the ends of the parallel plates. Reduction of the initial electron number over eleven orders of magnitude has very little gross effect on these pulses. Concentration of the initial electrons into a narrow, centered column generally results in reductions in rise time, FWHM, and pulse duration, as well as increases in peak voltage. Movement of the narrow column to the extreme left of the center electrode causes the voltage pulses at the left and right sides of the parallel plates to differ somewhat in their characteristics. 10 refs.

19983 (UCRL-JC–109222) **Heating and momentum deposition in hot stars.** Castor, J.I. Lawrence Livermore National Lab., CA (United States). Dec 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9107218–2: International Astronomical Union (IAU) conference on nonlinear phenomena in stellar variability, Buenos Aires (Argentina), 23 Jul - 1 aug 1991). Order Number DE92011850. Source: OSTI; NTIS; GPO Dep.

The coronae of hot stars are compared with those of the sun and other cool stars, and some important distinctions are drawn. Principal among these are that the hot star coronae readily radiate away any deposited energy, and that the overriding concern is how the momentum is deposited that drives their very vigorous winds. The features of radiatively driven winds are reviewed, with particular attention to their evidently very complex, and presently poorly known, spatial and temporal structure. Some possible explanations for the structure are considered.

19984 (UCRL-JC–109859) **X-ray transfer.** Castor, J.I. Lawrence Livermore National Lab., CA (United States). Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9202103–1: 10. international colloquium on ultra violet and x-ray spectroscopy of astrophysical and laboratory plasmas, Berkeley, CA (United States), 3-5 Feb 1992). Order Number DE92011961. Source: OSTI; NTIS; GPO Dep.

The computational techniques for treating radiative transfer in general, and x-ray transfer in particular, are reviewed, with emphasis on the difficult problems associated with systems that are not in local thermodynamic equilibrium. Some special aspects of x-ray transfer are mentioned. The computer code ALTAIR, developed at LLNL to solve such problems, is described briefly, with an example of x-ray fluorescence in a Seyfert galaxy. Some of the prospects for experimental tests of x-ray radiative transfer theory are considered.

19985 (UCRL-JC–110087) **Resonant Compton scattering in models of gamma-ray burst sources.** Vitello, P.A. Lawrence Livermore National Lab., CA (United States). Jan 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9110310–4: Gamma ray burst conference, Huntsville, AL (United States), 17-18 Oct 1991). Order Number DE92010720. Source: OSTI; NTIS; GPO Dep.

We consider here the spectra produced from the resonant Compton scattering of blackbody and power-law photons by a beam of relativistic electrons/positrons. The beam is assumed to be directed radially outward along the magnetic axis of a highly magnitized neutron star. We assume a dipole magnetic field geometry, and include the effects of magnetic Compton scattering energy losses on the particles in the beam during transport. A range of surface intensities for a magnetic field of 2×10^{12} Gauss are studied for a power-law electron/positron source functions of index Γ. The calculated scattered photon spectra are similar to observed gamma-ray burst spectra with a spectral index α which breaks from $\alpha \simeq 1$ to $\alpha \simeq \Gamma$.

19986 (UCRL-JC–110303) **Modeling of uv lines from cataclysmic variable winds.** Vitello, P.A. (Lawrence Livermore National Lab., CA (United States)); Shlosman, I. Lawrence Livermore National Lab., CA (United States). Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. Grant NAG5-1387. (CONF-9202103–2: 10. international colloquium on ultra violet and x-ray spectroscopy of astrophysical and laboratory plasmas, Berkeley, CA (United States), 3-5 Feb 1992). Order Number DE92013443. Source: OSTI; NTIS; GPO Dep.

Ultraviolet resonance lines appear to be powerful tools for diagnostics and study of the outflows from cataclysmic variable stars. The origin of these winds and their geometry are not known at present. In order to compare observed lines from the IUE database with synthetic line profiles from accretion disk winds, we have developed a numerical radiation transfer model for 3D non-radial, rotating winds from an accretion disk. Using this model we have studied line spectra from a number of cataclysmic variables. We find that good fits to be observed spectra can be obtained using disk winds for mass loss rates much smaller than the accretion rates.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 19261, 20165, 20168

19987 (DOE/ER/40627–1) **Elementary particle interactions: Progress report, October 1, 1990–September 30, 1991.** Bugg, W.M.; Condo, G.T.; Handler, T.; Hart, E.L.; Read, K.; Ward, B.F.L.; Close, F.E.; Barnes, T. Tennessee Univ., Knoxville, TN (United States). Dept. of Physics and Astronomy. Oct 1991. 369p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER40627. Order Number DE92011854. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: Data analysis of Fermilab E-745 and Fermilab E-782 neutrino experiments; light quark meson spectroscopy; L-3 detector; SLD detector; and SSC detector research and development.

19988 (SLAC–378, pp. 507-518) **Prospects in experimental particle astrophysics.** Webb, R.C. (Texas A and M Univ., College Station (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The application of standard particle physics techniques to cosmological and astrophysical questions has given rise to an exciting new area of physics research known as particle astrophysics. In the discussion which follows, the author summarizes some of the key elements of this research area and indicates some of the experimental directions in which one might see some progress as new experimental facilities are brought on line over the course of the next several years.

6621 General Theory of Particles and Fields

Refer also to citation(s) 20040, 20082, 20194

19989 (DESY–91-152) **Scaling behaviour of small volume physics in SU(2) lattice gauge theory.** Gutbrod, F. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 16p. (HLRZ–97/91). Order Number DE92516964. Source: OSTI; NTIS (US Sales Only); INIS.

A factor 2 scaling test for masses, derived from the correlation function of Polyakov loops, has been performed on physically small lattices with high precision. The test has been made at $\beta = 2.9$ and $\beta = 3.0$, comparing masses on lattices of size $16^3 \times 128$ and $16^3 \times 192$ resp. with masses on half sized lattices. Results for $\Delta\beta$ are significantly higher than those obtained by MCRG methods, by Creutz ratios and by the string tension on larger lattices. They are almost compatible with asymptotic scaling. (orig.).

19990 (DESY–92-006) **Unconstrained SU(2) and SU(3) Yang-Mills classical mechanics.** Dahmen, B. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Raabe, B. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 31p. Order Number DE92517041. Source: OSTI; NTIS (US Sales Only); INIS.

A systematic study of contraints in SU(2) and SU(3) Yang-Mills classical mechanics is performed. Expect for the SU(2) case with spatial angular momenta they turn out to be nonholonomic. The complete elimination of the unphysical gauge and rotatinal degrees of freedom is achieved using Dirac's constraint formalism. We present an effective unconstrained formulation of the general SU(2) Yang-Mills classical mechanics as well as for SU(3) in the subspace of vanishing spatial angular momenta that is well suited for further explicit dynamical investigations. (orig.).

19991 (DESY–92-015) **Self-organizing criticality, large anomalous mass dimension and the gauge hierarchy problem.** Bornholdt, S.; Wetterich, C. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Feb 1992. 14p. Order Number DE92517043. Source: OSTI; NTIS (US Sales Only); INIS.

Fermions and scalars contribute with opposite sign to the dependence of the scalar mass term m^2 on the length scale k^{-1}. We discuss the possibility that a "balance effect" between these contributions leads to an infrared stable fixpoint in the evolution of the ratio $m^2(k)/k^2$. Such a behavior would result in self-organizing critically and could naturally explain a small gauge hierarchy. It is closely related to a large anomalous mass dimension. (orig.).

19992 (DOE/ER/40107–11(B)) **Research in particle physics beyond the standard model (Task B): Final report, July 1, 1983–January 15, 1992.** Samuel, S. City Coll., New York, NY (United States). Dept. of Physics. [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83ER40107. Order Number DE92012240. Source: OSTI; NTIS; INIS; GPO Dep.

During the DOE funding period from 1987 to 1991 for Task A, research was carried out in fundamental particle physics in the areas of string field theory, string phenomenology, physics beyond the standard model and TEV physics. During this five year period more than 40 articles were published, including contributions to conference proceedings. The overall performance should be regarded as highly successful. The proposed research projects were either discovered to be not feasible to carry out or were successfully completed within a six month period. More than 50% of the proposed projects fell into the later category. In addition, many projects were successfully achieved that were not part of DOE proposals, simply because they could not be foreseen. Here is a summary of the research.

19993 (DOE/ER/40628–1) **[Studies in quantum field theory: Progress report, April 1, 1991–March 31, 1992].** Bender, C.M. Washington Univ., St. Louis, MO (United States). Dept. of Physics. [1992]. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40628. Order Number DE92011035. Source: OSTI; NTIS; INIS; GPO Dep.

Professors Bender, Bernard, and Shrauner, Assistant Professors Ogilvie and Goltermann, Research Assistant Professors Visser and Petcher, and Research Associate Rivas are currently conducting research in many areas of high energy theoretical and mathematical physics. These areas include: lattice gauge calculations of masses and weak matrix elements; strong-coupling approximation; low-energy effective field theories; classical solutions of non-Abelian gauge theories; mean-field approximation in quantum field theory; path integral and coherent state representations in quantum field theory; the nature of perturbation theory in large order; quark condensation in QCD; chiral fermion theories on the lattice; the 1/N expansion in quantum field theory; effective potential and action in quantum field theories, including QCD; studies of the early universe and inflation; quantum gravity. This work is described in detail in the body of this proposal.

19994 (FNAL/C–92/79) **Latest results on the direct CP violation measurements:** E'/ϵ. Hsiung, Yee B. E731 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-910836–3: 19. SLAC summer institute on particle physics, Stanford, CA (United States), 5-16 Aug 1991). Order Number DE92011378. Source: OSTI; NTIS; INIS; GPO Dep.

Preliminary results, based on the full data sample from Fermilab-E731 and the combined data sample from CERN-NA31, on the "direct" CP-violation measurements $\epsilon'\epsilon$ in neutral kaon decay have been reviewed. The E731's results if $\mathrm{Re}(\epsilon'\epsilon) = (6.0 \pm 5.8(\mathrm{stat}) \pm 3.2(\mathrm{syst}) \pm 1.8(\mathrm{MC})) \times 10^{-4}$, which provides no evidence for "direct" CP-violation, thus supporting the Superweak model; while the NA31's combined result (1986 + 1988 + 1989 data) is $\mathrm{Re}(\epsilon'/\epsilon = (23 \pm 3.4(\mathrm{stat})\ \pm 6.5(\mathrm{syst})) \times 10^4$, three standard deviations from zero, which provides evidence for the "direct" CP-violation in the Standard Model. Comparisons of the two experiments are made. The Fermilab-E731 group has also fit for the other parameters of the neutral kaon system in their 2π data sample, such as: the K_S life time τ_S; the K_L-K_S mass difference δm; the phase difference between η_{+-}, $\delta\phi = (-0.6 \pm 1.6)^\circ$). Which is a test of CPT invariance; the Superweak phase $\phi_{SW} = (43.37 \pm 0.22)^\circ$, and the phase of $\eta_\pm$, $\phi_\pm = (43.2 \pm 1.6)^\circ$, which is predicted by CPT invariance to equal ϕ_{SW}.

19995 (GSI–91-65(prepr.)) **The geometry of the thermal quasi-particle transformation.** Henning, P.A. (Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany)); Graf, M.; Matthaeus, F. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 22p. Order Number DE92516489. Source: OSTI; NTIS (US Sales Only); INIS.

We introduce a new concept for thermal quantum theories, which expresses a time dependent quasi-particle picture as the coupling to an external (classical) gauge field. The non-abelian nature of this field even for quasi-free systems can lead to renormalization factors that depend on the system's history. In this framework, the geometry of adiabatic time evolutions is investigated in detail, and implications for non-equilibrium systems are discussed. (orig.).

19996 (INIS-mf–13192, pp. 65-66) **Dynamics of solitons in the presence of dissipation and external forces.** Majernikova, E. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Solitons and solitary waves have been adopted as an approach to elementary excitations in low-dimensional complex systems with interactions. Many nonlinear equations of the quantum and classical field theories find application in models of solids. Some methods are given of the investigation of solitons using two "ϕ^4" nonlinear equations (equations with a bi-stable potential and the Sine-Gordon equation with a multi-stable potential) and of their modifications in relation to the effect of dissipation and of external forces. (Z.S.). 6 refs.

19997 (INIS-mf–13192, pp. 247) **Lattice investigation of strong Yukawa coupling.** Jersak, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. YUKAWA NONLOCAL THEORY; COUPLING; FERMIONS; HIGGS MODEL; MASS

19998 (INIS-mf--13192, pp. 247) **Unitarity bounds on scattering in a space-time of general dimension.** Fischer, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Chaichian, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SCATTERING/unitarity; SCATTERING; UNITARITY; SCATTERING AMPLITUDES; SPACE-TIME

19999 (INIS-mf--13194, pp. 31-42) **Fermionic and gauge fields in interaction - a question of anomalies.** Cronstroem, C. (Helsinki Univ. (Finland). Dept. of Theoretical Physics). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Anomalies in non-Abelian gauge theories are briefly discussed. Specifically, an account is given of the work of L.D. Fadeev (Phys. Lett. 145 B, 81 (1984)) and his co-workers on anomalies in the commutator algebra of the Gauss' law constraints for the theory of Yang-Mills fields interacting with chiral (left-handed) fermion fields. The considerations lead to the conclusion that the Hamiltonian operator formalism is at the present stage of development unable to provide a framework in which the anomalies are understood in a satisfactory manner. However, it appears that the anomalies in question can be well understood in the functional integral formalism. (Z.S.) 5 refs.

20000 (INIS-mf--13194, pp. 43-48) **Extended BRS-method and gauge-independence of anomalies.** Kummer, W. (Technische Univ., Vienna (Austria). 1. Inst. fuer Theoretische Physik). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

In the 'extended' BRS method the gauge-breaking term in the action receives a further contribution from the BRS variation of the gauge parameters. This is supplemented by symmetry transformations belonging to external auxiliary gauge fields and corresponding ghosts which are coupled to the 'external' anomalies of the theory. As an application of this new comprehensive cohomology relation, the gauge independence is shown of the anomaly related to the Rebhan-Kraemmer current of the bosonic string. (author) 10 refs.

20001 (INIS-mf--13194, pp. 74-96) **Semiclassical limit, confinement and field configurations in lattice QCD.** Campostrini, M. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy)); Di Giacomo, A.; Maggiore, M.; Panagopoulos, H.; Vicari, E.; Olejnik, S. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The study of semiclassical configurations, confinement and field configurations in lattice QCD has led to the following conclusions: string tension is produced by semiclassical configurations other than instantons; field configurations which produce confinement are chromoelectric flux tubes with a Gaussian transverse shape and a size of the order of half a Fermi; universality is obeyed; the best way to define a topological charge is the standard field theory. Topological charge survives cooling: possible losses of topological charge due to metastability can be monitored using the field theoretical definition. (Z.S.) 1 tab., 14 figs., 21 refs.

20002 (INIS-mf--13194, pp. 254-263) **Intermittent behaviour in the Ising model.** Novak, I. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A clear evidence of intermittency in the two-dimensional Ising model at the critical point is found. It is shown how to get rid of the statistical fluctuations due to the finite size of phase space windows, which allows to obtain intermittency starting from rather small lattices. The estimate of the fractal dimension of a set of sites with spin up found from calculations on the lattice of 64x64 is discussed as are the implications for a search of intermittency in multiparticle production. (author) 2 tabs., 2 figs., 8 refs.

20003 (INIS-mf--13194, pp. 271-276) **Elastic scattering and the problem of transparent nucleon.** Kundrat, V. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Lokajicek, M.; Krupa, D. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Two regions of momentum transfer in the differential cross section data on high-energy elastic hadron scattering are of great physical interest: the region of the diffraction minimum where the diffractive structure appears, and nearly forward scattering where the collisions mostly take place due to Coulomb scattering. Since there is no reliable theory for high energy diffractive scattering there are attempts to describe and eventually to correlate the differential cross sections at these two regions in a phenomenological way. Various recently published approaches are discussed including those based on the geometrical scaling equations, the West and Yennie form of the total scattering amplitude, etc. (Z.S.) 12 refs.

20004 (INIS-mf--13194, pp. 361-365) **Constraints, BRST-cohomology and stochastic quantization.** Hueffel, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A brief exposition of the BRST formalism is followed by an introduction of stochastic quantization in the extended configuration space. The appearance of a specific projection operator and its relation to BRST cohomology is pointed out. (author) 20 refs.

20005 (INIS-mf--13194, pp. 303-307) **Four-point meson-Green-functions in the strong coupling limit of lattice QCD.** Gasser, I. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik); Faber, M.; Feilmair, W.; Kainz, W.; Markum, H. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference*. Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The scattering matrix for elastic meson-meson scattering was determined in the strong coupling limit of lattice QCD. It was found that the strong coupling limit is able to describe resonance states. The scattering matrix has a pole which can be attributed to the propagation of a long-lived particle. (author) 2 figs., 4 refs.

20006 (INIS-mf–13194, pp. 387-391) **Scalar glueball and coupled channels.** Krupa, D. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Surovtsev, Y.S. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference*. Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A new method is proposed for analyzing the scalar meson scattering amplitude by means of its uniforming. This gives a compact formula for the analysis of the isoscalar s-wave pion-pion scattering in terms of the multipole resonance description. In order to extend the scattering matrix from the physical region to all unphysical sheets in the energy variable, the unitarity relation was used. It is shown that a simple description of the partial wave scattering amplitude can be achieved even in the presence of resonant states and other strongly coupled scattering channels. (Z.S.) 8 refs.

20007 (INS–912) **On the problem of soliton-impurity interaction.** Kudryavtsev, A.E. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jan 1992. 17p. Order Number DE92514985. Source: OSTI; NTIS (US Sales Only); INIS.

The scattering of soliton on impurity of δ-type for the classical $\lambda\psi_2{}^4$-theory is considered. In the case of small coupling with impurity the potential approach is shown to be valid. The energy losses of soliton, moving in the potential, are calculated. The problem of the so-called resonance-impurity interaction is also considered. (author).

20008 (ITF–89-43) **Supersymmetry in the problem of electron motion on a surface orthogonal to force lines of external magnetic field.** Sitenko, Yu.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 24p. (In Russian). Order Number DE92627217. Source: OSTI; NTIS (US Sales Only); INIS.

A supersymmetric quantum mechanics realized in the problem of two-dimensional electron motion in an external static magnetic field of arbitrary configuration is discussed. Zero modes of the supersymmetric Hamiltonian an compact and single-and double-connected surfaces are considered. The degeneracy of the supersymmetric ground state is found and the conditions of the spontaneous supersymmetry breaking are obtained. 21 refs.

20009 (ITF–89-45) **Non-standard representations of the physical groups and Heisenberg algebras and non-unitary quantization.** Sannikov, S.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 35p. (In Russian). Order Number DE92627218. Source: OSTI; NTIS (US Sales Only); INIS.

A mathematical apparatus of the non-unitary quantization method is developed. The non-standard (non-Fock) representations of the Heisenberg algebras and non-standard representations of their automorphism groups underlies this theory. Extended Fock representations of the Heisenberg algebras are built. 17 refs.

20010 (ITP–89-42) **Multiloop calculations in p-adic string theory and Bruhat-Tits trees.2.** Zabrodin, A.V.; Mironov, A.D.; Chekhov, L.O. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 36p. Order Number DE92627219. Source: OSTI; NTIS (US Sales Only); INIS.

The open p-adic string world sheet as a coset space $F=T/\Gamma$, where T is the Bruhat-Tits tree for the p-adic linear group $GL(2.Q_p)$ is some Schottky group is treated. The boundary of this world sheet corresponds to p-adic Mumford curve of finite genus. The string dynamics is governed by the local Gaussian action on the coset space F. The tachyon amplitudes expressed in terms of p-adic Θ-functions are proposed for the Mumford curve of arbitrary genus and compared with the corresponding usual archimedian amplitudes. 41 refs.; 14 figs.

20011 (ITP–89-57) **Semiclassical approach to ground states within Klein-Gordon equation.** Kobylinskij, N.A.; Stepanov, S.S.; Tutik, R.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 9p. Order Number DE92627259. Source: OSTI; NTIS (US Sales Only); INIS.

A new method for deriving Regge-trajectories and energy eigenvalues for ground states of central potentials is applied to the Klein-Gordon equation. Based upon the $\hbar$-expansion, the simple recursion formulas are presented. The problems of the π-mesonic atom and funnel-shaped potential are treated with this technique. 12 refs.; 1 tab.

20012 (ITP–89-58) **$\hbar$-expansion for Regge-trajectories: 1. The Schroedinger equation.** Kobylinskij, N.A.; Stepanov, S.S.; Tutik, R.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 23p. Order Number DE92627215. Source: OSTI; NTIS (US Sales Only); INIS.

The $\hbar$-expansion provides a powerfull new, complimentary to the WKB method, tool for deriving Regge-trajectories and energy eigenvalues for bound states of central potentials in the Schroedinger equation framework. Based upon the logarithmic perturbation theory in Planck's constant, the simple recursion formulas which facilitate the calculation are presented. Numerical calculations for specific potentials widely used in the quarkonium physics illustrate the speed and accuracy of the technique. 23 refs.; 6 tabs.

20013 (ITP–89-82) **The partition function of 2d-Ising model with the magnetic fields on bounderies and $C=1/2$ virasoro characters.** Bugrij, A.I.; Shadura, V.N. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 13p. Order Number DE92627220. Source: OSTI; NTIS (US Sales Only); INIS.

The partition function of a planar Ising model on a finite lattice with magnetic fields on the boundaries is represented through the anticommuting functional integral with Gaussian distribution. In particular, the previously unknown solution for the case of fields of opposite direction is obtained. It is shown also that the partition function of the model at the critical point in the continuous limit can be expressed through certain characters of highest-weight irreducible representations of Virasoro algebra. 15 refs.

20014 (ITP–90-5) **Asymptotic representations of the running parameters in Yang-Mills theories.** Maksimov, S.I.; Vovk, V.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 12p. Order Number DE92627223. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that a unique perturbative solution to the renormalization group (RG) equation for the running coupling constant (RCC) exists. The general representations of the running coupling constant and mass in the form of asymptotic expansions are explicity derived. A two-parameter ambiguity in these expansions which leaves invariant the full result is discovered. This feature is observed to be an attribute of the particular type of transcedental equations resulting from the differential RG equation for the RCC. 16 refs.

20015 (ITP–90-16) **Vanishing of vacuum energies in gauged extended supergravity compactified on torus.** Bytsenko, A.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 13p. Order Number DE92627221. Source: OSTI; NTIS (US Sales Only); INIS.

A mechanism of the cosmological constant vanishing in gauged $N=4$ supergravity on the background $M_p=T^p x R^{4-p}$ at finite temperature is analyzed. Here T^p, R^{4-p} are the p-dimensional torus and the flat space respectively, $p=1,...,4$.It is shown that this mechanism results from the one-loop Casimir effect. 16 refs.

20016 (ITP–90-46) **New method of massive Feynman diagrams calculation. Vertex-type functions.** Kotikov, A.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 20p. Order Number DE92627222. Source: OSTI; NTIS (US Sales Only); INIS.

Vertex functions are calculated in the framework of differential equation method. As an example of calculation of one- and two-loop diagrams, it is shown that by analogy with propagator-type diagrams this method provides a simple procedure of evaluating the result without D- space integrals (for the dimensional regularization) calculation. 13 refs.

20017 (KEK-PROC–91-8, pp. 133-137) **Large CP violation in B_s decays and light W_R.** Nishiura, H. (Osaka Univ., Toyonaka (Japan). Coll. of General Education); Takasugi, E.; Tanaka, M. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. (CONF-9008241–: KEK summer institute on high energy phenomenology, Tsukuba (Japan), 21-25 Aug 1990). In *Proceedings of the KEK summer institute on high energy phenomenology.* 145p. Order Number DE92782188. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CP INVARIANCE/intermediate bosons; CP INVARIANCE/b mesons; KOBAYASHI-MASKAWA MATRIX; REST MASS; WEAK HADRONIC DECAY; FLAVOR MODEL

20018 (OUP–92-01) **Dynamics of magnetic fields in Maxwell, Yang-Mills and Chern-Simons theories on the torus.** Burgess, M. (Oslo Univ., Fysisk Inst. (Norway)); McLachlan, A.; Toms, D.J. Oslo Univ. (Norway). Fysisk Inst. Jan 1992. 92p. Order Number DE92628449. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of uniform magnetic fields passing perpendicularly through a 2-torus, Abelian and Non-Abelian, is considered. Focus is on dynamical effects of non-integrable phases on the torus at non zero B and from magnetic fields themselves in the vacuum. The spectrum is computed and is shown to be always independent of the non-integrable phases on the torus. It is concluded that a Chern-Simons term will always be induced by radiative corrections to fermions on the torus when $B \neq 0$. The special case of an electromagnetically uncharged anyon gas in noted and shown to be a system whose spectrum can depend on the non-integrable phases in the two torus directions, subject to a consistency requirement. In three and four dimensions, dynamical symmetry breaking of non-Abelian fields and associated condensate formation is possible by radiative corrections. The classification on non-Abelian magnetic fields in terms of "flux integers" is discussed, and a method for obtaining such integers for an arbitrary gauge algebra is presented. This provides a rigorous generalisation of Hooft's su (2) classification. 72 refs., 5 figs.

20019 (UWThPh–1991-54) **The geometric phase and the Schwinger term in some models.** Grosse, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Langmann, E. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 18 Dec 1991. 33p. Order Number DE92627224. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss quantization of fermions interacting with external fields and observe the occurrence of equivalent as well as inequivalent representations of the canonical anticommutation relations. Implementability of gauge and axial gauge transformations leads to generators which fulfill an algebra of charges with Schwinger term. This term can be written as a cocycle and leads to the boson-fermion correspondence. Transport of a quantum mechanical system along a closed loop of parameter space may yield a geometric mechanical system along a closed loop of parameter space may yield a geometric phase. We discuss models for which nonintegrable phase factors are obtained from the adiabatic parallel transport. After second quantization one obtains, in addition, a Schwinger term. Depending on the type of transformation a subtle relationship between these two obstructions can occur. We indicate finally how we may transport density matrices along closed loops in parameter space. (authors).

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 20005, 20120, 20124, 20125, 20134, 20135, 20145, 20226, 20227, 20230, 20231, 20232, 20233, 20234

20020 (CONF-9105202–, pp. 6, Paper 5) **The lattice QCD grand challenge.** Kilcup, G. (Ohio State Univ., Columbus (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Until relatively recently, a taxonomist of science would divide most areas of physics into two types: theoretical and experimental. With the advent of large scale computing, however, there is now another recognized field: computational physics. For there is now another recognized field: computational physics. For High Energy Physics one of the most prominent manifestations of this phenomenon is the emergence of the discipline known as lattice Quantum Chromodynamics, or lattice QCD. Problems which a decade ago seemed intractable are not succumbing to large scale numerical simulations. These simulations are consuming vast amounts of computer time these days, and promise to do so for at least the next decade. To take but one example, in each of the last three years, the Department of Energy has allocated several thousand Cray-2 hours at NERSC for the computation of certain weak interaction matrix elements. In the following pages the author will give a brief overview of this and some other projects.

20021 (DESY–91-151) **Thermal equilibrium during the electroweak phase transition.** Tetradis, N. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 20p. Order Number DE92516965. Source: OSTI; NTIS (US Sales Only); INIS.

The effective potential for the standard model develops a barrier, at temperatures around the electroweak scale, which separates the minimum at zero field and a deeper non-zero minimum. This could create out of equilibrium conditions by inducing the localization of the Higgs field in a metastable state around zero. In this picture vacuum decay would occur through bubble nucleation. I show that there is an upper bound on the Higgs mass for the above scenario to be realized. The barrier must be high enough to prevent thermal fluctuations of the Higgs expectation value from establishing thermal equilibrium between the two minima. The upper bound is estimated to be lower than the experimental lower limit. This is also imposes constraints on extensions of the standard model constructed in order to generate a strongly first order phase transition. (orig.).

20022 (DOE/ER/40652–1) **[Pion interferometry search for a phase change in hadronic matter in relativistic heavy ion collisions and its application to RHIC: Progress report].** Cherney, M. Creighton Univ., Omaha, NE (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40652. Order Number DE92011436. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this research is to assist in the investigation of the behavior of hadronic matter under extreme conditions. Specifically, this project intends to actively involve Creighton students and faculty in the search for indications of a phase transition from hadronic to quark matter. It is believed that the conditions necessary for the formation of this quark-gluon plasma include large energy densities over extended volumes. The technique of boson interferometry may prove to be the effective tool in verifying the existence of a quark-gluon plasma. This project continues active collaboration with Department of Energy research centers working on the NA36, NA44, and STAR experiments. It involves the effective development of the hardware, software and analytical skills required for a large relativistic heavy ion facility at Brookhaven National Laboratory (RHIC). Integral to this endeavor are educational opportunities for students at Creighton University.

20023 (FNAL/C–91/335-A) **Constraints on fermion mixing with exotics.** Nardi, E. (Michigan Univ., Ann Arbor, MI (United States). Randall Lab. of Physics); Roulet, E.; Tommasini, D. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 7p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC02-76CH03000. Grant NAGW 1340. (FTUV–91-52;UM-TH–91-31;CONF-9110332–2: International workshop on electroweak physics beyond the standard model, Valencia (Spain), 2-5 Oct 1991). Order Number DE92011701. Source: OSTI; NTIS; INIS; GPO Dep.

We analyze the constraints on the mixing angles of the standard fermions with new heavy particles with exotic SU(2) x U(1) quantum number assignments (left-handed singlets or right-handed doublets), that appear in many extensions of the electroweak theory. The updated Charged Current and Neutral Current experimental data, including also the recent Z-peak measurements, are considered. The results of the global analysis of all these data are then presented.

20024 (FNAL/C–91/349-A) **The physics of strange matter.** Olinto, A.V. (Chicago Univ., IL (United States). Dept. of Astronomy and Astrophysics). Fermi National Accelerator Lab., Batavia, IL (United States). Dec 1991. 27p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH03000 ;FG02-91ER40606. Grant AST-22595;Grant NAGW-2381. (CONF-9108186–3: Relativistic aspects of nuclear physics, Rio de Janeiro (Brazil), 2-30 Aug 1991). Order Number DE92011734. Source: OSTI; NTIS; INIS; GPO Dep.

Strange matter may be the ground state of matter. We review the phenomenology and astrophysical implications of strange matter, and discuss the possible ways for testing the strange matter hypothesis.

20025 (FNAL/C–92/20-A) **Quark matter and cosmology.** Schramm, D.N. (Chicago Univ., IL (United States)); Fields, B.; Thomas, D. Fermi National Accelerator Lab., Batavia, IL (United States). Jan 1992. 16p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH03000 ;FG02-91ER40606. Grant AST 90-22629;Grant NAGW-1381;Grant NAGW-1321. (CONF-9111165–12: Quark matter '91, Gatlinburg, TN (United States), 11-15 Nov 1991). Order Number DE92011736. Source: OSTI; NTIS; INIS; GPO Dep.

The possible implications of the quark-hadron transition for cosmology are explored. Possible surviving signatures are discussed. In particular, the possibility of generating a dark matter candidate such as strange nuggets or planetary mass black holes is noted. Much discussion is devoted to the possible role of the transition for cosmological nucleosynthesis. It is emphasized that even an optimized first order phase transition will not significantly alter the nucleosynthesis constraints on the cosmological baryon density nor on neutrino counting. However, it is noted that Be and B observations in old stars may eventually be able to be a signature of a cosmologically significant quark-hadron transition. It is pointed out that the critical point in this regard is whether the observed B/Be ratio can be produced by spallation processes or requires cosmological input. Spallation cannot produce a B/Be ratio below 7.6. A supporting signature would be Be and B ratios to oxygen that greatly exceed galactic values. At present, all data is still consistent with a spallagenic origin.

20026 (HEPHY-PUB–562-91) **Significance of relativistic wave equations for bound states.** Rupprecht, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Schoeberl, F.F.; Lucha, W. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. Nov 1991. 24p. (UWThPh–1991-56.). Order Number DE92628500. Source: OSTI; NTIS (US Sales Only); INIS.

We scrutinize the relevance of relativistic wave equations for the description of quark-antiquark bound states. By comparing the predictions of the nonrelativistic Schroedinger equations (with the only lowest-order relativistic corrections of the famous Breit - Fermi Hamiltonian), the spinless Salpeter equation, and a new semirelativistic wave equation (which incorporates relativistic kinematics and the complete relativistic corrections to the static interaction potential) for light and heavy quarkonia within three different models, we discuss the extent to which the use of relativistic wave equations is reasonable or necessary in order to reproduce the experimentally observed meson mass spectra. We are forced to conclude that - contrary to one's physical intuition - a relativistic treatment of bound states by a potential provides no improvement at all compared to the corresponding nonrelativistic description. (authors).

20027 (HEPHY-PUB–563-91) **Prospects of SUSY-searches. A theoretical overview.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Majerotto, W.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. Oct 1991. 15p. (UWThPh–1991-43.). Order Number DE92627263. Source: OSTI; NTIS (US Sales Only); INIS.

Predictions within the minimal supersymmetric standard model for SUSY particle searches at HERA, LEP200, and LHC/SSC are presented. Possible signatures are discussed. (authors).

20028 (IFVE-OTF–91-39) **Relativistic formulation of quark model.** Zorin, O.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 10p. (IHEP-OTF–91-39.). Order Number DE92627282. Source: OSTI; NTIS (US Sales Only); INIS.

A relativistic model, which describes spin-orbital excitations of quark-antiquark bound system, is proposed. A formulation of the model provides the meson classification established in frame of the nonrelativistic quark model. 3 refs.

20029 (IHEP-OTF–91-91) **Asymptotic freedom and the single-time reduction technique in quantum chromodynamics.** Arkhipov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 21p. Order Number DE92627272. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Teor. Mat. Fiz.

It is shown in what way the asymptotic freedom manifests itself in terms of two-quark interaction quasipotential in quantum chromodynamics. 9 refs.

20030 (INIS-mf–13179, pp. 17-27) **Quark-gluon plasma in the laboratory and in the early universe.** Banerjee, B. (Tata Inst. of Fundamental Research, Bombay (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Quantum chromodynamics predicts a first order phase transition from confined hadronic matter to unconfined quark-gluon plasma (QGP) at a temperature in the range 100-200 MeV. It is probable that such a temperature can be reached in collisions between two heavy ions moving at relativistic energies. Such experiments have been performed in CERN and BNL in the last two years, although so far it has been possible to use only light nuclei as projectiles. The main problem thrown up by these experiments is the determination of the signal for the formation of the QGP. The suggestions made so far and their status are discussed. In the standard big-bang (SSB) model of the universe, for explaining the primordial nucleosynthesis it is assumed that the universe started with a uniform distribution of hadrons and leptons. When the temperature of the universe fell below 2 MeV the nucleons fused together to form the light nuclei ^{2}H, ^{4}He and ^{7}Li. Recently it has been pointed out that when the temperature of the universe was about 100 MeV it would have undergone the same phase transition mentioned above, albeit from the QGP to the hadronic phase. As a result there would have been an inhomogeneous distribution of nucleons and not a homogeneous one as assumed in SSB. Because of the inhomogeneity the primordial nucleosynthesis processes would have been altered. The consequences and implications of this changed picture of the nucleosynthesis in the early universe are discussed. (author). 25 refs., 3 figs.

20031 (INIS-mf–13179, pp. 1-16) **Nuclear physics beyond neutrons and protons.** Jain, B.K. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

In the contemporary picture the consituents of the nucleus, neutrons and protons, are composed of quarks and gluons. Their dynamics is described by the QCD, in which the chiral symmetry is a basic ingredient. Around the centre of the nucleons this symmetry is very much obeyed, which near the surface is violated, giving rise to the non-conservation of the axial vector current. It is believed that on the surface of the nucleons this symmetry is restored by the birth of pions. Thus, looking from the inside of the nucleons the pions provide an additional axial vector current to restore the chiral symmetry and for the nuclear physics they provide the basic starting point for its dynamics. The nucleons themselves, in this picture, are surrounded by a cloud of pions and their resonances. Physically this picture leads to the differences in the measured radii of the nucleons using different probes and a simple description of the charge-exchange spin-isospin flip reactions. It also puts the propagation of pions and rho-mesons (a resonant state of two pions probably) in nuclear medium in a category of basic importance. The first excited state of the nucleon, the Δ-isobar, to which the pions couple very strongly, acquires, in a natural way, a very significant place in the nuclear dynamics. (author). 10 refs., 4 figs.

20032 (INIS-mf–13192, pp. 125-126) **Physics of the standard model of electroweak interactions.** Horejsi, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The Glashow-Salam-Weinberg (GSW) standard model (SM) of electroweak interactions is a theory unifying weak and electromagnetic interactions based on principles of non-Abelian calibration invariance and the Higgs mechanism. The SM agrees well with all existing experimental data, and experiments performed so far confirmed the predicted properties of interactions of intermediate vector bosons (IVBs) with fermions (leptons and quarks). The disclosure of the existence and structure of neutral, fermion currents was an experimental landmark thanks to which the GSW theory was actually recognised as a realistic (i.e., standard) model of electroweak interactions even before IVBs were discovered. The GSW theory also predicts another particle which has not yet been observed, the Higgs' boson. Among the most remarkable, already confirmed predictions of the SM are formulas for the masses of IVBs following from the presumed specific (minimum) variant of the Higgs mechanism. (Z.S.). 5 refs.

20033 (INIS-mf–13192, pp. 129-130) **Tests of the standard model at the HERA accelerator.** Cvach, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Investigation of lepton-hadron collisions at the Hadron-Elektron-Ring-Anlage (HERA) in DESY Hamburg is aimed at the elucidation of the internal structure of nucleons. Due to the high centre-of-gravity energy, the cross sections for the formation of heavy c and b quarks are sufficiently large to enable the mechanism of formation of the corresponding heavy mesons to be studied. During scattering to high angles ($Q^2 >\approx 10\ 000$ GeV^2), weak processes become stronger than electromagnetic processes. This allows the prediction of the Salam-Weinberg model to be tested in a new kinematic region. A basic task of experiments studying the scattering of leptons on hadrons consists in the measurement of inelastic scattering. The differential cross section, which depends not only on the collision energy but also on two additional kinematic variables, can be used to determine the structure functions of nucleons. In the HERA energy region the cross sections for the formation of particles with the open quantum number grace and beauty ("heavy flavors") are sufficiently large and the background is fairly low compared with the case of colliding hadron beams. The dominant process in the formation of particles with heavy flavors Q = c,b is the boson-gluon fusion mechanism. The total cross sections for the inclusive formation of a c (b) quark in the lowest order of the perturbation theory are 10^6 (85.10^3) pbarn. (Z.S.). 3 refs.

20034 (INIS-mf–13192, pp. 103-108) **Non-classical properties of new quantum states of light.** Kral, P. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A new view upon light using quantum theory is presented. Quantum optics is part of the nonrelativistic quantum theory and its experiments relate to quantum mechanics fundamentals. Those properties are considered non-classical that cannot characterize an electromagnetic field described by Maxwell's equations. Some conceivable applications of quantum optics are given. (Z.S.). 6 figs., 15 refs.

20035 (INIS-mf–13192, pp. 109-112) **Photon interference and quantum noise of light.** Hradil, Z. (Palackeho Univ., Olomouc (Czechoslovakia). Prirodovedecka Fakulta). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The fundamental topics addressed by quantum optics are briefly commented on. They include, e.g., the quantum description of uncertainties (noises), quantum interference, complementarity of the wave and particle description of light, etc. (Z.S.). 10 refs.

20036 (INIS-mf–13192, pp. 247) **The similarity transformed Dyson mapping and the interacting boson model.** Navratil, P. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Dobes, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BOSON-EXCHANGE MODELS/dyson representation

20037 (INIS-mf–13194, pp. 97-105) **Vector mesons and chiral symmetry.** Ecker, G. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The ambiguities in the off-shell behavior of spin-1 exchange can be resolved to $O(p^4)$ in the chiral low-energy expansion if the asymptotic behavior of QCD is properly incorporated. As a consequence, the chiral version of vector (and axial vector) meson dominance is model independent. Additional high-energy constraints motivated by QCD determine the V,A resonance couplings uniquely. In particular, QCD in its effective chiral implementation successfully predicts $\Gamma(\rho\rightarrow2\pi)$. (author) 10 refs.

20038 (INIS-mf–13194, pp. 106-116) **Dynamical and explicit chiral symmetry breaking.** Scadron, M.D. (Arizona Univ., Tucson, AZ (United States). Dept. of Physics). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

By blending together chiral symmetry models such as nonperturbative QCD and the four-fermion model combined with the linear σ model, it was possible to deduce a unique pattern of constituent and current quark masses and quark couplings that are compatible with hadron measurements. (author) 8 figs., 29 refs.

20039 (INIS-mf–13194, pp. 151-163) **Self-consistent transport equations and QCD plasma oscillations.** Elze, H.-T. (European Organization for Nuclear Research, Geneva (Switzerland)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Motivated by the collective plasmon instability and gauge-fixing dependence, one-loop gauge covariant gluon transport equations are discussed (based on canonical background gauge quantization with a self-consistency condition to determine the classical field). Implications as to non-perturbative behavior of quark-gluon plasma are mentioned. (author) 22 refs.

20040 (INIS-mf–13194, pp. 164-182) **Non-trivial dynamical features of parton-parton scattering at the ISR.** Geist, W.M. (European Organization for Nuclear Research, Geneva (Switzerland)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental verification of the non-Abelian nature of QCD is a challenge. A new approach is presented which is based upon a good knowledge of the kinematic configuration of flavor-identified quarks and gluons emerging at large polar angles from proton-proton collisions at the ISR. It is also shown that inclusive cross sections for high transverse momentum mesons and details of the event topology are simultaneously reproduced quantitatively in the framework of higher order QCD. All relevant data were taken with the Split Field Magnet detector at the CERN ISR. (author) 1 tab., 12 figs., 17 refs.

20041 (INIS-mf–13194, pp. 291-295) **Transverse momenta and energies in J/ψ production.** Gupta, S. (Bielefeld Univ. (Germany). Fakultaet fuer Physik). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Computations of nuclear effects in J/ψ production cross sections using perturbative QCD are reported. A toy model for generating correlations between the hadronic transverse energy and the transverse momentum of the J/ψ is described. (author) 4 figs., 8 refs.

20042 (INIS-SU–312, pp. 3-12) **Problems of hadron electrodynamics.** Rekalo, M.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

Certain directions of hadron electrodynamics referring to testing symmetry properties relatively to C-, P- and T-transformations; determination of fundamental electromagnetic characteristics of hadrons as well as to clarifying the dynamics of electromagnetic processes in which hadrons participate are analyzed briefly. 52 refs.

20043 (ITF–90-16) **Effective action for order parameters and the problem of phase transitions in lattice QCD thermodynamics.** Borisenko, O.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 44p. (In Russian). Order Number DE92627275. Source: OSTI; NTIS (US Sales Only); INIS.

The phase structure of lattice SU(N)-chromodynamics is discussed. An effective action for Polyakov lines of quark and baryon condensates is constructed for the Euclidean formulation of theory with naive fermions at finite temperatures and baryon number densities. The behaviour of respective averages and the interrelation between them are studied. 25 refs.

20044 (ITP–89-45) **Vacuum polarization and dynamical chiral symmetry breaking in quantum electrodynamics.** Gusynin, V.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 15p. Order Number DE92627269. Source: OSTI; NTIS (US Sales Only); INIS.

The Schwinger-Dyson equation in the ladder approximation is considered for the fermion mass function taking into account the vacuum polarization effects. It is shown that even in the 'zero-charge' situation there exists, at rather large coupling constant ($\alpha>\alpha_c>0$), a solution with spontaneously broken chiral symmetry. The existence of the local limit in the model concerned is discussed. 30 refs.; 1 fig.

20045 (ITP–89-55) **Analysis of colour screening in a QCD plasma within analytically solvable model.** Borisenko, O.A.; Petrov, V.K.; Zinov'ev, G.M. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 11p. Order Number DE92627276. Source: OSTI; NTIS (US Sales Only); INIS.

The connected correlation functions of the Polyakov's loops are analytically analyzed within the approximation of the spherical model for an effective action of lattice QCD at finite temperature. The Coulomb-like behaviour of an imaginary part correlator is found, supporting the idea of a phase transition generated by spontaneous breaking of CP-symmetry. 18 refs.

20046 (ITP–89-72) **Dilepton spectrum from quark-gluon plasma in second Born approximation.** Makhlin, A.N. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 29p. Order Number DE92627277. Source: OSTI; NTIS (US Sales Only); INIS.

The real time temperature Keldysh technique has been used to calculate the rate of dilepton emission from quark-gluon plasma in the first order with respect to strong coupling constant. This approximation us shown to be inconsistent. The radiative corrections turned to be of the same order as the contribution of real processes with gluons. Nevertheless the general properties inherent in dilepton emission from continuous media can be verified by measuring the lepton distribution inside the dilepton. 11 refs.; 2 figs.

20047 (ITP–89-73) **Renormalization scheme invariant predictions for deep-inelastic scattering and determination of Λ_{QCD}.** Vovk, V.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 16p. Order Number DE92627278. Source: OSTI; NTIS (US Sales Only); INIS.

Theoretical aspects of the renormalization scheme (RS) ambiguity problem and the approaches to its solution are discussed from the point of view of QCD phenomenology and the scale Λ determination. The method of RS-invariant perturbation theory (RSIPT) as a sound basis for describing experiment in QCD is advocated. To this end the method is developed for the non-singlet structure functions (SF) of deep-inelastic scattering and recent high precision data on SF's are analyzed in a RS-invariant way. It is shown that RSIPT leads to a more accurate and reliable determination of the QCD scale Λ, which is consistent with the theoretical assumption of a better convergence of RS-invariant perturbative series. 24 refs.; 1 tab.

20048 (ITP–89-81) **Mixed fermion-photon condensate in strongly coupled quantum electrodynamics.** Gusynin, V.P.; Kushnir, V.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 12p. Order Number DE92627270. Source: OSTI; NTIS (US Sales Only); INIS.

The existence of a new mixed fermion-photon condensate breaking chiral symmetry in strongly coupled phase of quantum electrodynamics is shown. An analytical expression for the renormalized condensate is obtained. 20 refs.; 2 figs.

20049 (ITP–89-83) **Constraints on parameters of gauge theories of interaction from comparison of theoretical and experimental values for anomalous magnetic moments of charged leptons.** Studenikin, A.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 19p. Order Number DE92627264. Source: OSTI; NTIS (US Sales Only); INIS.

A short of the theoretical and experimental approach to the problem of the anomalous magnetic moment of a charged lepton is presented. The comparison of the precise theoretical and experimental values of the anomalous magnetic moments of the electron and muon provides an ideal tool for testing the validity of theoretical framework. The rigorous bounds on some parameters of different models of interaction are obtained and discussed. 49 refs.

20050 (ITP–90-21) **Supplementing analysis of deconfined phase in lattice QCD thermodynamics.** Bohacik, J.; Borisenko, O.A.; Petrov, V.K.; Zinovjev, G.M. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 12p. Order Number DE92627279. Source: OSTI; NTIS (US Sales Only); INIS.

Using strong coupling expansion an expectation value of matter field colour density is calculated in the Hamiltonian formulation of lattice QCD at finite temperature with the staggered fermions. The relation of this value to the imaginary part of fundamental representation character changing the sign under the colour charge conjugation is found out. It is also shown that this expectation value could be used as an order parameter of the phase transition associated with the breaking of the colour charge conjugation symmetry. 12 refs.

20051 (ITP–90-84) **Nonperturbative quantum electrodynamics at $T\neq0$.** Pevzner, M.Sh. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 21p. Order Number DE92627271. Source: OSTI; NTIS (US Sales Only); INIS.

On the base of Schwinger-Dyson equation for the electron temperature Green's function in the nonperturbative QED in the ladder approximation the ordinary differential equation for the function, connected with temperature one has been obtained. The relation, to which the temperature depending electron mass m(T) satisfies, has been found; its low-temperature behaviour has been studied. The phase transition has been shown to take place in the model, that is accompanied by the chiral symmetry restoration. 34 refs.

20052 (ITP–91-11) **Multiple rescatterings and spin structure of a baryon-baryon scattering amplitude.** Martynov, E.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1991. 8p. Order Number DE92627283. Source: OSTI; NTIS (US Sales Only); INIS.

An elastic baryon-baryon interaction with multiple rescatterings taken into account is considered. The simple algebraic expressions that relate six independent amplitudes for such a process with input spin amplitudes are obtained within the impact parameter representation. 5 refs.

20053 (LBL–31483) **Review of CERN heavy-ion physics.** Odyniec, G. Lawrence Berkeley Lab., CA (United States). Nov 1991. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9108186–2: Relativistic aspects of nuclear physics, Rio de Janeiro (Brazil), 2-30 Aug 1991). Order Number DE92010259. Source: OSTI; NTIS; INIS; GPO Dep.

Results from the heavy-ion experiments at the CERN SPS are reviewed in the context of possible formation and identification of a quark-gluon plasma (QGP).

20054 (RAL–92-005) **Minimal supersymmetric unification predictions.** Ross, G.G. (Oxford Univ. (United Kingdom). Dept. of Theoretical Physics); Roberts, R.G. Rutherford Appleton Lab., Chilton (United Kingdom). Jan 1992. 28p. Order Number DE92628485. Source: OSTI; NTIS (US Sales Only); INIS.

We re-examine the predictions for the gauge couplings in the minimal extension of the standard model which result from the assumption that the model comes from a unified theory with a single scale of breaking. The effects of thresholds are considered both at the unification scale and at the low-energy scale of the new supersymmetric states. The latter are found to be particularly important and are analysed using the supergravity spectrum corresponding to common scalar and gaugino masses plus other soft supersymmetry breaking terms corrected by gauge and Yukawa radiative corrections. The analysis is extended to include the prediction for the W boson mass coming from the radiatively induced spontaneous symmetry breaking of the standard model. The requirement that this be within the measured value without fine tuning strongly limits the magnitude of the supersymmetry breaking scale and the resulting predictions for the detailed mass spectrum of the supersymmetric states and the Higgs bosons. The bottom quark mass is also determined using the full two-loop renormalisation group equation with the unification prediction $m_b = m_t$ at the compactification scale. (author).

20055 (SLAC–378, pp. 123-142) **Top quark topics.** Kane, G.L. (Univ. of Michigan, Ann Arbor (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

These lectures survey why the top quark may be unusually interesting if its mass is large. Perhaps the large mass is related to a fundamental role of the top quark. Perhaps it will have non-Standard Model decays, or be sensitive to some new physics.

20056 (SLAC–378, pp. 167-198) **Theoretical topics in B-physics.** Bjorken, J.D. (Stanford Univ., CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The bottom quark should need no introduction. Other than the undiscovered top quark, it is by far the most fashionable of the six. There is good reason for this. It is bottom-quark behavior which holds out the most hope of measuring and understanding some of the most fundamental and delicate parameters of the standard model - those having to do with the origin of electroweak mixing - and thereby in all probability also the origin of quark mass. Also interwoven into this is the subject of CP violation, and its proposed interpretation in terms of electroweak mixing. In this section the author shall review the basics of electroweak mixing and how it is impacted by the study of b-quark properties. There are by now many lecture series and workshop proceedings devoted to this topic, the author will not try to be comprehensive, but only hit some highlights.

20057 (SLAC–378, pp. 403-414) **Baryon number violation at high energy in the standard model: Fact or fiction?.** Dine, M. (Univ. of California, Santa Cruz (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. DOE Contract AC02-83ER40107. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

In the standard model, baryon and lepton number are not strictly conserved, due to anomalies. It has long been known that at low energies, the resulting baryon number violating amplitudes are extraordinarily small. A number of authors have suggested that at high temperatures or energies, baryon number violating effects should be enhanced. The author gives simple arguments that while baryon number violation is indeed large at high temperatures, there is no such enhancement at high energies.

20058 (SLAC–378, pp. 415-429) **New particle searches at LEP.** Buijs, A. (CERN, Geneva (Switzerland)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Since the startup of the LEP accelerator, providing e^+e^- collisions at center-of-mass energies corresponding to the mass of the Z^0, many searches for new particles have been performed by the four big experiments ALEPH, L3, DELPHI and OPAL. In this talk the author will describe a few of these searches: the search for the sixth quark, and for a new quark from a possible fourth family; the search for the Standard Model Higgs and for Higgs doublets from Super Symmetric models; and the search for excited quarks and leptons. The techniques used in these searches are representative for other searches not described in this talk. The MARK II collaboration at the SLC has performed a series of searches as well. In spite of the low statistics, some of the limits obtained at the SLC are comparable to those from LEP and close to the kinematic limit. However, they are not part of this talk. In anticipation of the conclusion section he should say that no new particles have been found at LEP, and therefore all results are expressed in terms of lower limits, mostly at the 95% confidence level.

20059 (SLAC–378, pp. 431-452) **Review of QCD at LEP.** de Boer, W. (Univ. of Karlsruhe (West Germany)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The author reviews the first round of QCD studies at the e^+e^- collider LEP, which started operating towards the end of last year. These studies at the peak of the Z^0 resonance have proven to be extremely rewarding, not only because of the large statistics available due to the high resonance cross section, but also because of the higher center of mass energy, which allows a much cleaner study of events with multiple jets. For example, 20% of the events show a clean 3-jet structure in which the least energetic jet has an average energy of 20 GeV. Such events originate from quark-antiquark-gluon ($q\bar{q}g$) states, in which the least energetic jet is usually the gluon jet. Therefore, at LEP energies the gluon jets are considerably healthier than at the PEP and PETRA colliders, where the energies were typically three times lower. The higher jet energy gives a better collimation of the jets and therefore a better jet axis determination and separation between the jets. This improves many QCD studies, especially the study of gluon jets and the angular correlations in 4-jet events, from which one can hope to isolate the triple gluon vertex contribution. This gluon self interaction is the hallmark of the non-abelian character of QCD and is thought to be responsible for the confinement of quarks inside the nuclei. The topics to be discussed here are: intermittency; charged multiplicity and rapidity distribution; comparison with fragmentation models; soft gluon coherence; jetmultiplicity studies and the determination of α, determination of α, from the asymmetry in energy-energy correlations; and search for the triple gluon vertex.

20060 (UWThPh–1991-42) **Susy at lep and future colliders.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Majerotto, W.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 1991. 6p. Order Number DE92627265. Source: OSTI; NTIS (US Sales Only); INIS.

Predictions within the Minimal Supersymmetric Standard Model for SUSY particle searches at LEP200 and LHC/SSC are presented. Possible signatures are discussed. (authors).

20061 (UWThPh–1991-52) **Magic moments with John Bell.** Bertlmann, R.A. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 7 Nov 1991. 12p. Order Number DE92627280. Source: OSTI; NTIS (US Sales Only); INIS.

The collaboration with John Bell is recalled. Quantum field theory methods to calculate properties of quark-antiquark bound states are illustrated in a nonrelativistic context. (author).

20062 (UWThPh–1991-57) **Particle production and decay in the minimal supersymmetric standard model.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Majerotto, W.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 1991. 22p. Order Number DE92627266. Source: OSTI; NTIS (US Sales Only); INIS.

We study pair production and decay of supersymmetric particles in e^+e^- collisions at $\sqrt{s} = 500$ GeV, exploring the relevant supersymmetry parameter space. We give numerical predictions for cross sections and important signatures. (authors).

20063 (UWThPh–1991-58) **Introduction.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Dittmar, M.; Majerotto, W. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 1991. 9p. Order Number DE92627267. Source: OSTI; NTIS (US Sales Only); INIS.

The following four basic parameters are necessary to specify the SUSY particle sector of the MSSM: m_0, M, μ and tan β. Production cross sections as well as decay rates depend in a characteristic way on these parameters. A systematic study of this dependence in the whole parameter space relevant for this energy is performed. It is been shown that the clean experiments possible at e^+e^- machines and the precisely calculable cross sections will allow us to probe the realization of supersymmetry in this energy range. Concerning the explorable SUSY parameter range, a 500 GeV e^+e^-collider is roughly comparable to the LHC. Whereas at the LHC the strongly interacting SUSY particles up to a high mass can be detected, an e^+e^-collider is best suited for a detailed study of the non-strongly interacting SUSY particles. (authors).

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Refer also to citation(s) 19257, 19262, 19275, 19276, 19319, 19994, 20033, 20040, 20056, 20058, 20059, 20142, 20163, 20211

20064 (BONN-IR–91-67) **Studies on the $D^{*\pm}$ production in Z^0 decays.** Geerts, M. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1991. 52p. (In German). Order Number DE92511425. Source: OSTI; NTIS (US Sales Only); INIS.

The production of $D^{*\pm}$ mesons in e^+e^- collisions at energies around the Z^0 pole has been investigated with the OPAL detector at LEP. 115 D^* mesons have been found in the decay channel $D^* \to D^0\pi \to (K\pi)\pi$ from about 150 000 multihadronic events, using the small mass difference between D^* and D^0. The cuts, the detection efficiency and different methods for background determination are shown. The D^* energy distribution is determined. D^* mesons are produced predominantly in the fragmentation of charm and bottom quarks. The contribution from b quarks is derived from measurements at LEP and at lower energies, and from Monte Carlo calculations. An average energy fraction of the D^* mesons from primary charm quarks, $<\chi_{c \to D}{}^*> = 0.52 \pm 0.03$, and the Peterson fragmentation parameter $\epsilon_c = 0.038 \pm 0.014$ are found. The partial width of the decay Z^0 into canti c is determined to be Γsub($Z^0 \to$canti c) = (323 ± 70) MeV. (orig.).

20065 (BONN-IR–91-69) **Determination of the momentum distributions of charged hadrons from Z^0 decays by means of dE/dx measurements in the jet chamber of the OPAL detector.** Tesch, N. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1991. 71p. (In German). Order Number DE92517032. Source: OSTI; NTIS (US Sales Only); INIS.

Inclusive measurements of momentum distributions of $\pi^\pm$, $K^\pm$ and panti p are presented from an analysis of approximately 145000 hadronic decays of the Z^0 collected in 1990 with the OPAL detector at LEP. The rates of the charged hadrons are determined by simultaneous measurement of the momentum and the energy loss $dE/d\chi$ for each charged track. Fits to the $dE/d\chi$ distributions in several momentum bins are performed using 4 gaussian functions. From the entries under each of these 4 gaussians the rates for the most numerous charged particle types ($e^\pm$, $\pi^\pm + \mu^\pm$, $K^\pm$ and panti p) are calculated and corrected for efficiency and other detector-dependent effects. With these rates the momentum distributions and the fragmentation functions for $\pi^\pm$, $K^\pm$ and panti p are derived and compared to Monte Carlo predictions. Good agreement is found with the JETSET model with the exception of low momentum protons. (orig.).

20066 (BONN-IR–91-73) **Point-shaped and partonic photon at HERA: Simulation calculations for the ZEUS experiment.** Desch, K. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ.

(Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1991. 77p. (In German). Order Number DE92511568. Source: OSTI; NTIS (US Sales Only); INIS.

We investigate cross sections, kinematics and topology of photoproduction events at HERA. Different event generators for pointlike and resolved photon processes are compared. Remarkable effects arise from initial state gluon radiation. An approach to optimize the First Level Trigger of the ZEUS-Experiment for photoproduction physics is given using a full Monte-Carlo simulation of the detector and the trigger logic. The trigger efficiencies are shown to be above 90% for bottom production while the background keeps low. Some aspects of event classification and kinematical reconstruction of photon gluon fusion events are given. (orig.).

20067 (BONN-IR–91-75) **Search for top and leptoquarks in the region of the Z^0 resonance.** Simon, A. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Nov 1991. 102p. (In German). Order Number DE92517029. Source: OSTI; NTIS (US Sales Only); INIS.

A search for top- and leptoquarks has been performed with data from the OPAL detector at the e^+e^- storage ring LEP using isolated, high momentum leptons as a signature. Leptoquarks, containing lepton and baryon number, decay into a quark and either a charged lepton (e, μ, τ) or a neutrino. In a data sample corresponding to an integrated luminosity of $6.6pb^{-1}$ no evidence for top- or leptoquark production in either of the possible decay modes was obsrved. This places a lower limit of 46.6 GeV on the top-quark mass (47.1 GeV for a forth family b'-quark). For leptoquarks an upper limit of 1.7pb on the production cross section is obtained assuming a branching ratio of 50% for the decay of the leptoquark into the channels with a charged lepton. Allowing all decay modes of the leptoquark pair, including those where the decay products are from different fermion families, lower limits on the leptoquark mass between 41.4 and 46.4 GeV/c^2 at 95% CL are obtained, depending on the effective SU(2)xU(1) invariant couplings assigned to the leptoquark. (orig.).

20068 (CONF-9105238–7) **Electromagnetic lepton-pair production in relativistic collisions.** Albert, C.J. (Texas A and M Univ., College Station, TX (United States)); Ernst, D.J.; Strayer, M.R.; Bottcher, C. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Conference on computational quantum physics; Nashville, TN (United States); 22-25 May 1991. Order Number DE92011069. Source: OSTI; NTIS; INIS; GPO Dep.

Electromagnetic lepton-pair production in relativistic collisions is studied in an ab initio approach with no free parameters. After a semi-classical approximation to the relative motion of the two incident particles is made, the resulting second-order diagram is calculated using a Monte Carlo technique to evaluate the resulting seven-dimensional integral. We examine the case of electron-positron pair production in π^-p collisions at p_{pl} = 17 GeV. We find that a significant fraction of the measured pairs in this reaction are produced via the magnetic spin-flip current of the proton. Approaches, such as the equivalent photon approximation, which neglect this part of the current predict much too small a cross section. This feature is traced to the cuts imposed in taking the experimental data. Lepton-pair production in the scattering of ^3He, ^4He and ^4He, ^4He is proposed as a clean way of experimentally separating the spin-flip and non-flip processes; predictions are made for these systems.

20069 (CONF-910864–13) **Charge exchange photoproduction and the $a_1(1260)$.** Condo, G.T.; Handler, T.; Blackett, G.R. Tennessee Univ., Knoxville, TN (United States). Dept. of Physics. [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER40627. From 4. international conference on hadron spectroscopy; College Park, MD (United States); 12-16 Aug 1991. Order Number DE92012267. Source: OSTI; NTIS; INIS; GPO Dep.

Although recent analyses of τ-lepton decay and a reanalysis of hadron production data gave consistent results for the mass of the $a_1(\sim1250$ MeV), other results, both experimental and theoretical, have suggested a significantly smaller value for this parameter. The purpose of this talk is to present our data on the charge-exchange photoproduction reaction, $\gamma\rho \rightarrow \Delta^{++}\pi^+\pi^-\pi^-$. Our data derive from a hydrogen bubble chamber experiment, performed at SLAC, utilizing incident photons of average energy 19.3 GeV with a full width at half-maximum of 1.7 GeV.

20070 (DESY–91-109) **Signals of new gauge bosons.** Djouadi, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Leike, A.; Riemann, T.; Schaile, D.; Verzegnassi, C. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 10p. (CONF-9109374–: Workshop on physics and experiments with linear colliders, Saariselkae (Finland), Sep 1991). Order Number DE92516967. Source: OSTI; NTIS (US Sales Only); INIS.

We analyze signals of additional neutral gauge bosons originating from E_6 and Left-Right models, at a future e^+e^- collider with 500 GeV c.m. energy. Radiative corrections as well as the experimental situation are taken into account. We show that masses considerably higher than the total energy can be probed, and that a discrimination between theoretical models is possible. (orig.).

20071 (DESY–91-128(rev.ed.)) **Radiative corrections for associated ZH production at future e^+e^- colliders.** Kniehl, B.A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Nov 1991. 42p. Order Number DE92517037. Source: OSTI; NTIS (US Sales Only); INIS.

The ZF fanti f four-point function is calculated in the one-loop approximation of the standard model and full analytic results are presented. The loop contributions due to both light and new heavy fermions are inspected in detail. The dominant mechanisms of Higgs-boson production from fermions are compared. The effect of radiative corrections on the cross section of fanti f→ZH including bremsstrahlung is studied. The spectrum of hard bremsstrahlung is integrated analytically. The implications for Higgs-boson searches at future e^+e^- colliders in the energy range 200 GeV $\leq \sqrt{s} \leq$ 1.5 TeV, which includes both LEP 2 and the Next Linear Collider, are analyzed. For $M_H<2m_t$ weak corrections in the modified on-mass-shell scheme are generally negative and feebly vary with M_H, while for $M_H>2m_t$, they strongly increase with M_H and may take large positve values. Electromagnetic corrections dramatically reduce the cross section close to the ZH-production threshold, while they may considerably enhance it far above this threshold. (orig.).

20072 (DESY–91-140) **Signals of new gauge bosons at future e^+e^- colliders.** Djouadi, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Leike, A.; Riemann, T.; Schaile, D.; Verzegnassi, C. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 34p. (CERN-TH–6350/91;ETH-TH–91/43;LMU–91/05). Order Number DE92516966. Source: OSTI; NTIS (US Sales Only); INIS.

We analyze possible indirect signals of additional neutral gauge bosons at future e^+e^-- colliders, concentrating on $SU(2)_L$ x $U(1)_y$ x $U(1)_y$, and $SU(2)_L$ x $SU(2)_R$ x U(1) effective theories. We develop a simple formalism to describe these effects and make a careful study of radiative corrections, in particular initial state radiation, which will be shown to have important implications. To make realistic estimates of the sensitivity to the new gauge boson effects, we use a model detector for e^+e^- annihilation at a center of mass energy of 500 GeV. Using a number of selected physical observable we then show that masses considerably higher than the total energy (up to a factor of 6) can be probed and that distinction between various theoretical models is possible. (orig.).

20073 (DESY–91-154) **Measurement of hot spots inside the proton at HERA and LEP/LHC.** Bartels, J. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Roeck, A. de; Loewe, M. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 22p. Contract FONDECYT 0367/90. Order Number DE92516963. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper we discuss the measurement of regions in the proton where the density of small-χ partons is large, called 'hot spots', by means of an associated jet analysis. An analytical estimate of the cross section is presented and the jet kinematics is discussed in the HERA and LEP-LHC frame. A Monte Carlo estimate shows that the number of jets produced in deep inelastic scattering events at HERA, suitable for this analysis, amounts to a few 1000 jets for a data sample with an integrated luminosity of about 10 pb^{-1}. (orig.).

20074 (DESY–91-155) **Probing $WW\gamma$ and $WW\gamma\gamma$ couplings with high energy photon beams.** Choi, S.Y.; Schrempp, F. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 14p. (CONF-9109328–: Physics with e^+e^- linear colliders, Hamburg (Germany), 2-4 Sep 1991). Order Number DE92516979. Source: OSTI; NTIS (US Sales Only); INIS.

We examine the potential of a future 500 GeV linear e^+e^- collider for probing anomalous WW_γ and $WW_{\gamma\gamma}$ couplings in the so-called $\gamma(\gamma)$model, corresponding to colliding γe and $\gamma\gamma$ beams from Compton backscattering of laser light. We consider in detail the 'minimal' set (k_γ, λ_γ) of CP conserving anomalous couplings and present first results for the CP violating 'partner' couplings (anti K_γ, anti l_γ) as well. The reactions under consideration are $\gamma e \rightarrow W\nu$, $\gamma\gamma \rightarrow W^+W^-$ and, as a reference, also $e^+e^- \rightarrow W^+W^-$. We discuss the impact of both circular polarization of laser photons and polarized e(anti e) beams. Photon 'beams' due to classical Bremsstrahlung are also studied for comparison. We analyze in detail, how changes of the assumed machine parameters, cuts and systematic errors affect the sensitivity to the anomalous couplings. (orig.).

20075 (DESY–92-004) **$WW\gamma$ couplings from single W-production in polarized e^+e^- collisions.** Philipsen, O. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 27p. Order Number DE92517033. Source: OSTI; NTIS (US Sales Only); INIS.

Using the process $e\gamma \rightarrow W\nu$ we study the $WW\gamma$ vertex in $\epsilon^+\epsilon^-$ collisions with polarized beams at a future 500 GeV collider. Analytical expressions for the helicity amplitudes of the process $e\gamma \rightarrow W\nu$ are evaluated and a derivation of the equivalent photon approximation is given for the case of polarized electron beams. The resulting photon spectrum is then used to compute the total cross section as well as various differential distributions for the process $\epsilon^+\epsilon^- \rightarrow \epsilon^+W^-\nu$. Special emphasis is put on the effects of using polarized electron beams and their influence on the sensitivity to anomalous couplings. (orig.).

20076 (DESY–92-005) **Technibaryon production at pp colliders.** Dobado, A. (Universidad Complutense de Madrid (Spain). Dept. de Fisica Teorica); Terron, J. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 49p. (UCMFT–10/91). Order Number DE92517039. Source: OSTI; NTIS (US Sales Only); INIS.

If the symmetry breaking sector of the Standard Model is strongly interacting, the low-energy dynamics of the longitudinal components of the weak bosons can be described by a non-linear sigma model with two free parameters. For a large range of these parameters the model supports finite energy solitons called weak Skyrmions or technibaryons. Technibaryons could be produced at the SSC giving rise to exotic experimental signatures since they are stable, heavy and, in some cases, fractional-charged particles. PACS:14.80.-j, 12.50Lr. (orig.).

20077 (DESY–92-007) **Direct CP asymmetries in the decays B→VV from an effective weak hamiltonian.** Kramer, G. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Palmer, W.F. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 17p. Contract DE-AC02-76ER01545;BMFT 054HH92P/3. Order Number DE92517040. Source: OSTI; NTIS (US Sales Only); INIS.

We calculate QCD coefficients for the effective operators for B decays at the m_b and m_c scale and use them to calculate branching ratio's, polarization and CP asymmetries in the decay of B mesons to two vector mesons. The numerical results are compared to experimental data. (orig.).

20078 (DESY–92-008) **Search for charm production in direct decays of the Υ(1S) resonance.** Albrecht, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Ehrlichmann, H.; Hamacher, T.; Krueger, A.; Nau, A.; Nippe, A.; Nowak, S.; Reidenbach, M.; Schaefer, M.; Schroeder, H.; Schulz, H.D.; Walter, M.; Wurth, R.; Appuhn, R.D.; Hast, C.;.ARGUS Collaboration. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 17p. Contract BMFT 054DO51P;BMFT 054ER12P;BMFT 055HD21P;BMFT 054KA17P Order Number DE92517035. Source: OSTI; NTIS (US Sales Only); INIS.

The production of $D^*(2010)^+$ and J/ψ mesons and of prompt leptons has been investigated in e^+e^- interactions at the $\Upsilon(1S)$ resonance energy. The data were collected at the storage ring DORIS II at DESY with the ARGUS detector. We obtain upper limits of $BR^{dr}(\Upsilon(1S) \rightarrow D^*(2010)^{\pm}+X)<0.019$ (for $\chi_p>0.2$) and $BR^{dr}(\Upsilon(1S) \rightarrow J/\psi+X)<0.68x10^{-3}$, both at the 90% confidence level. From the prompt lepton analysis, a model dependent limit of $BR^{dr}(\Upsilon(1S) \rightarrow Y_c+X)<0.034$ (Y_c denoting a charm-containing particle) is derived. (orig.).

20079 (DESY–92-009) **$Z^0 \rightarrow d_i$anti d_j CP asymmetry in a model with an extra vector-like singlet quark.** Roldan, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Botella, F.J.; Vidal, J. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 17p. (FTUV–92-5;IFIC–92-5). Order Number DE92517036. Source: OSTI; NTIS (US Sales Only); INIS.

We study the CP asymmetry $Z^o \rightarrow d_id_u$anti d_j, $d_j$anti d_i in the context of models with an extra heavy vector-like singlet D quark. We show that values for the asymmetry much larger than the Standard Model predictions can be obtained and possibly checked at LEP with upgraded luminosity or next future high energy colliders. (orig.).

20080 (DESY–92-013) **Search for neutrinoless τ decays.** Albrecht, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Ehrlichmann, H.; Hamacher, T.; Krueger, A.; Nau, A.; Nippe, A.; Nowak, S.; Reidenbach, M.; Schaefer, M.; Schroeder, H.; Schulz, H.D.; Walter, M.; Wurth, R.; Appuhn, R.D.; Hast, C.;.ARGUS Collaboration. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 29p. Contract BMFT 054DO51P;BMFT 054ER12P;BMFT 055HD21P;BMFT 054KA17P Order Number DE92517044. Source: OSTI; NTIS (US Sales Only); INIS.

Upper limits on branching ratios for six neutrinoless leptonic, 16 semileptonic, two radiative-leptonic, two radiative-hadronic and three purely hardronic τ decays have been determined. The results improve over previously published ones by about a factor of two. For the first time the lepton and baryon previously published ones by about a factor of two. For the first time the lepton and baryon number violating decays $\tau^- \rightarrow$anti $p\gamma$, $\tau^- \rightarrow$anti $p\pi^0$ and $\tau^- \rightarrow$anti $p\eta$ have been investigated. The 90% confidence level (CL) limits for the corresponding branching ratios amount to $2.9x10^{-4}$, $6.6x10^{-4}$ and $1.3x10^{-3}$ respectively. (orig.).

20081 (DESY–92-014) **Non-linear QCD effects in the pomeron parton dynamics.** Ingelman, G. (Uppsala Univ. (Sweden). Dept. of Radiation Sciences); Janson-Prytz, K. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jan 1992. 10p. (TSL/ISV–91-0055). Order Number DE92517042. Source: OSTI; NTIS (US Sales Only); INIS.

The x- and Q^2-dependence of the patron structure function of the pomeron is investigated based on perturbative QCD. We demonstrate that a large gluon content and small size of pomeron leads to strong non-linear QCD effects in the Q^2-evolution as described by the Gribov-Levin-Ryskin equation. In diffractive electron-proton scattering at HERA this phenomenon should be observable and is predicted to be of larger magnitude than the corresponding non-linear effect in the proton structure function. (orig.).

20082 (FNAL/C–92/65) **Kaon physics at Fermilab Main Injector.** Hsiung, Y. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9112111–1: KEK workshop on rare kaon decay physics, Tsukuba (Japan), 10-11 Dec 1991). Order Number DE92011094. Source: OSTI; NTIS; INIS; GPO Dep.

For high precision and high sensitivity studies of the physics of kaon physics of kaon decays, the important characteristics of the new Main Injector at Fermilab are its high energy (relative to other "factories") and its high intensity. Experiments of this kind are becoming increasingly important in the study of CP violation and for searches for new interactions. An extracted beam of 120 GeV will produce a source of high energy kaons (10–50 GeV) that will not be surpassed in intensity by any facility new under consideration world-wide.

20083 (HEPHY-PUB–550-91) **Slepton and squark production and decay in ep collision at the LHC.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Majerotto, W.; Oshimo, N.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. Jun 1991. 25p. (UWThPh–1991-14.). Order Number DE92628519. Source: OSTI; NTIS (US Sales Only); INIS.

We present a detailed study of $e+p \to e+q+X$ and $e+p \to v+q+X$ and the subsequent decays of e,v, and q at the LHC ($\sqrt{s} = 1.4$ TeV). We explore the relevant supersymmetry parameter range. We calculate the cross section as well as the rates for interesting signatures such as the production of one or two leptons on the lepton side. (authors).

20084 (HEPHY-PUB–566-91) **Production and decay of supersymmetric particles at future colliders.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Majerotto, W.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 1991. 34p. (UWThPh–1991-60.). Order Number DE92628511. Source: OSTI; NTIS (US Sales Only); INIS.

We describe how supersymmetric particles could be detected at the new colliders HERA, LEP 200, LHC, SSC, and at the possible future linear e^+e^- collider. We shall present theoretical predictions for production cross sections and decay probabilities, as well as for the important signatures. Our calculations will be based on the Minimal Supersymmetric Standard Model (MSSM) which is the simplest supersymmetric extension of the Standard Model. (authors).

20085 (IFVE-OEF–91-41) **Study on mechanism of X(1740) meson production.** Alde, D. (and others); Binon, F.; Bricman, C. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 8p. (In Russian). Order Number DE92627299. Source: OSTI; NTIS (US Sales Only); INIS.

New data on the narrow X(1740)-meson which is produced in π^-p charge-exchange reaction at 38 GeV/c momentum and decays into η-pair are presented. The data confirm the existence of this particle. Upper limits are obtained for its width and branching ratios for $\eta'\eta$ and $\pi^0\pi^0$ decay channels. It is shown that X(1740) is produced with very low cross section (1.5 nb) being accompanied by nucleon isobar (probably $\Delta(1232)$). Analogous reaction with a neutron as a recoil has not been observed. One-pion-exchange contribution to the mechanism of X(1740) production is strongly suppressed. 8 refs.

20086 (IFVE-OEF–91-49) **Large-x_F spin asymmetry in π^0 production by 200-GeV polarized protons: E704 experiment at FNAL.** Adams, D.L. (and others); Akchurin, N.; Underwood, D.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 9p. (In Russian). Order Number DE92627300. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the journal Phys. Rev. Lett.

The spin asymmetry A_N for inclusive π^0 production by 200 GeV transversely-polarized protons on a liquid hydrogen target has been measured at Fermilab over a wide range of x_F, with $0.5<p_t<2$ GeV/c. At $x_F>0.3$, the asymmetry rises with increasing x_F and reaches a value of $A_N=0.15\pm0.03$ in the region $0.6<x_F<0.8$. An interpretation of this result using a simple parton recombination model suggests that the spin of the proton is carried by its valence quarks. 20 refs.; 3 figs.; 2 tabs.

20087 (IFVE-ONF–91-128) **Simple model for description of the multiplicity distribution in pp, p-barp and meson-proton interactions.** Chikilev, O.G.; Shlyapnikov, P.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 7p. (In Russian). Order Number DE92627301. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the journal Yad.Fiz.

The description of experimental data on the negatively charged particle multiplicity distributions in pp, p-barp and meson-proton interactions by means of two-parameter functions deduced from a simple phenomenological model is considered. 18 fers.; 1 fig.; 1 tab.

20088 (IFVE-ONF–91-165) **Search for prompt electron neutrino production in the proton beam-dump on iron with the IHEP-JINR detector.** Anikeev, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Bamburov, N.S.; Bozhko, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 10p. (In Russian). Order Number DE92627296. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Yad. Fiz.

A search for prompt neutrinos in the new proton beam-dump experiment was performed at the IHEP accelerator Protvino for the measurement of the charm production cross section in the interaction of 70 GeV protons with iron nuclei. The IHEP-JINR neutrino calorimeter with fiducial mass 50 t was used a detector. No signal from prompt neutrinos was observed in the detected electron neutrino interactions, which yielded the improved upper limit on the charm production cross section 2.4 μb/nucleon (90% C.L.). This result does not contradict the QCD predictions. 14 refs.; 5 figs.; 1 tab.

20089 (IHEP-OEIUNK–91-95) **Observation of the decay $a_2^-(1320) \to \pi^-\eta'$.** Bityukov, S.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Borisov, G.V.; Vishnevsky, N.K. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 7p. Order Number DE92627308. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys., C.

The reaction $\pi^-C \to \pi^-\eta'C$ has been studied at 36 GeV/c. A clear signal for the decay $a_2^-(1320) \to \pi^-\eta'$ is observed in the $\pi^-\eta'$ mass spectrum. The measured ratio of branchings is $BR(a_2^- \to \pi^-\eta')/BR(a_2^- \to \pi^-\eta)=(3.4\pm0.8\pm0.5) \times 10^{-2}$. 6 refs.; 8 figs.

20090 (IHEP-ONF–91-74) **Linear estimates of structure functions from deep inelastic lepton-nucleon scattering data. Part 1: Neutral-charged current muon and electron scattering.** Anikeev, V.B.; Zhigunov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 34p. Order Number DE92627288. Source: OSTI; NTIS (US Sales Only); INIS.

This paper concerns the linear estimation of structure functions from muon(electron)-nucleon scattering. The expressions obtained for the structure functions estimate provide correct analysis of the random error and the bias The bias arises because of the finite number of experimental data and the finite resolution of experiment. The approach suggested may become useful for data handling from experiments at HERA. 9 refs.

20091 (IHEP-ONF–91-79) **Linear estimates of structure functions from deep inelastic lepton-nucleon scattering data. Part 2: Charged current (anti)neutrino scattering.** Anikeev, V.B.; Zhigunov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 38p. Order Number DE92627297. Source: OSTI; NTIS (US Sales Only); INIS.

The paper concerns the linear estimation of structure functions from (anti)neutrino-nucleon scattering. The expressions obtained for the structure functions estimate provide correct analysis of their random error and the bias. The bias arises because of the finite number of experimental data and the finite resolution of experiment. 10 refs.

20092 (IHEP-OTF–91-117) **Direct manifestation of the additional isoscalar bosons in the process $e^+e^- \to$ ff-bar at LEP.** Gershtein, S.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Likhoded, A.A.; Yushchenko, O.P.; Pankov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 6p. Order Number DE92627289. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Lett., B.

The phenomenological manifestation of the additional $Y(Y_L)$ boson arising in the models with the composite structure of electroweak interactions is studied for the process $e^+e^- \rightarrow$ ff-bar at the LEP energies. It is shown that the presence of the additional isoscalar boson, which can provide the explanation of the experimentally observed deviation of R_μ value from the Standard Model predictions at TRISTAN, yields a measurable effect in the cross section of $e^+e^- \rightarrow \mu^+\mu^-$(hadrons) processes at LEP. The increase of statistics for the above processes at TRISTAN and LEP will permit to set an additional limitation on the model parameters. 7 refs.; 6 figs.

20093 (IHEP-OTF--91-148) **Probing the heavy Higgs sector via $\gamma\gamma \rightarrow W_L^+W_L^-$, Z_LZ_L at a TeV linear collider.** Boos, Eh.Eh. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Jikia, G.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 10p. Order Number DE92627290. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the journal Phys. Lett., B.

The one-loop amplitudes of the enhanced electroweak strength, $O(g^2M_H{}^2/M_W{}^2)$ or $O(g^2s/M_W{}^2)$, for the reaction $\gamma\gamma \rightarrow Z_LZ_L$, $W_L{}^+W_L{}^-$ in the limit $s, M_H{}^2 >> M_W{}^2$ are calculated. It is found that the corresponding cross sections seem to be sufficiently large to establish a signal for the heavy Higgs boson $M_H \geq 1$TeV. 16 refs.; 3 figs.

20094 (IHEP-OTF--91-163) **Chiral dynamics and hadron scattering at small and large angles.** Troshin, S.M.; Tyurin, N.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 11p. Order Number DE92627302. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the Int. J. Mod. Phys. A.

The unified dynamics of hadron scattering at large and small distances is discussed in the framework of the unitarization method based on the introduction of generalized reaction matrix. The picture of hadron interactions used is inspired by the models with spontaneously broken chiral symmetry. 21 refs.; 1 fig.

20095 (INFN-AE--90-15) **Manifestations of heavy extra neutral E_6 gauge bosons in $e^+e^- \rightarrow W^+W^-$ at LEP II.** Pankov, A.A. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)); Paver, N. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1990. 11p. Order Number DE92627291. Source: OSTI; NTIS (US Sales Only); INIS.

24 refs.

The manifestations of a new neutral gauge boson (Z') with $M_z' > \sqrt{s}$, which might exist in E_6 models, in the process $e^+e^- \rightarrow W^+W^-$ at LEP II have been sudied. It has been found that the differential cross section is quite sensitive to the existence of a heavy Z'. In particular, $d\sigma/d\cos\theta$ should show the effect of heavier Z' bosons with $M_z' > 350$ GeV as an enhanced effect due to the Z-Z' mixing.

20096 (INFN-AE--91-09) **Measurement of the top mass near the threshold at an e+ e- collider.** Stiegler, V. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 17p. Order Number DE92627292. Source: OSTI; NTIS (US Sales Only); INIS.

In this note a method for measuring the top mass at a linear e+ e-collider near the tt production threshold is presented using properties of the tt final states. A resolution on the top mass of $400 MeV/c^2$ with an integrated luminosity of $1 fb^{-1}$ is obtained.

20097 (INFN-AE--91-12) **A measurement of the partial hadronic widths of the Z grade using neural networks.** Bortolotto, C. (Udine Univ. (Italy): Ist. di Fisica); Cosmo, G.; De Angelis, A.; Lihussio, A.; Eerola, P.; Kalkkinen, J. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 14p. Order Number DE92627309. Source: OSTI; NTIS (US Sales Only); INIS.

19 refs.

From the data collected by the DELPHI detector at LEP during 1990, the hadronic branching fractions of the Z neutral boson into all five known quarks have been measured for the first time in the literature. A classifier based on a feed-forward neural network has been used for separating the handronic decays of the Z neutral into four classes, corresponding to (xxxxx) unresolved, ss, cc, bb. Data on the hard final-state photon radiation have been then used to resolve the decay rate into uu pairs from the decay rate into dd pairs. The preliminary results are consistent with the predictions from the Standard Model. Problems related to the estimate of systematics are discussed.

20098 (INFN-AE--91-15) **How large can be direct CP violation in $K \rightarrow 3\pi$ from chiral perturbation theory.** D'Ambrosio, G. (Istituto Nazionale di Fisica Nucleare, Naples (Italy)); Isidori, G.; Paver, N. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 8p. Order Number DE92627310. Source: OSTI; NTIS (US Sales Only); INIS.

19 refs.

Using a general parametrization, the size of direct CP violation in charged $K \rightarrow 3\pi$ decays, as it should be expected from chiral perturbation theory including chiral corrections to order p^4 is discussed. These terms are required in order to remove the $\Delta I = 3/2$ suppression . It is argued that the magnitude of these effects for the slope asymmetry, although enhanced by the $\Delta I1/2$ rule, should be at most of the order of 10^{-5}.

20099 (INFN-BE--91-05) **The study of $\nu_e e^-$ scattering with neutrino source.** Broggini, C. (Ist. Nazionale Di Fisica Nucleare, Laboratori Nazionali del Gran Sasso, Assergi (Italy)). Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 4p. Order Number DE92627293. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of using a radioactive source to study the $\nu_e e^-$ scattering is discussed. In order to have a strong signal in a 100 gr/cm^2 thick liquid scintillator surrounding the source and in order to be sensitive to a low magnetic moment of the neutrino the threshold on the electron recoil energy has to be set very low, around 200 keV. This has two consequences: a huge experimental setup and a big active volume, where the expected signal due to ^{8}Be solar neutrinos is as high as the one produced by a large magnetic moment of the neutrinos from source.

20100 (INIS-mf--13192, pp. 131-134) **Results and plans from hadron colliders - search for the Higgs.** Lobkowicz, F. (Rochester Univ., NY (United States)). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The finding of the Z and W and the search for the Higgs particle are discussed. The Z decays into a muon pair or an electron pair, and once the two decay particles are identified the mass reconstruction is trivial. A quarter-view is presented of the Texas Supercollider Solenoid detector used for detecting Z particles, and the performance of a similar detector - the CDF facility at the Fermilab Tevatron - is descibed. The detection of the W is more complicated, since it decays into a muon (or electron) and a neutrino which cannot be observed. The "transverse mass" of the W can be determined using only the transverse components of the lepton (muon or electron) momentum and the "missing transverse momentum" which can be found from the momentum conservation in the plane perpendicular to the beams. The Higgs particle, which has as yet not been found, is discussed, as well as the potential experimental methods used for its determination. (Z.S.). 5 figs., 6 refs.

20101 (INIS-mf--13192, pp. 247) **Self-similar processes in high energy physics.** Blazek, M. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PARTICLE INTERACTIONS/ particle rapidity; ANNIHILATION; ELECTRON-POSITRON INTERACTIONS

20102 (INIS-mf--13194, pp. 49-63) **The fractal structure of multihadron production at high energies.** Satz, H. (European

Organization for Nuclear Research, Geneva (Switzerland)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The paper opens with a short general introduction to intermittency and fractal structure and a discussion of how self-similar patterns can arise in particle production. Then it is shown that at high energies, self-similar jet production leads to a universal power law behavior for the multiplicity moments as a function of the relative rapidity $Y/\delta y$, once the rapidity intervals δy are large enough to be outside the usual resonance region ($\delta y \geq 1$-2). Data from the UA5 experiment at CERN (for $\sqrt{s}$ = 200, 546 and 900 GeV) are found to agree very well with the predicted universal behavior. (author) 7 figs., 9 refs.

20103 (INIS-mf–13194, pp. 64-73) **Hadron spectra and collective transverse flow in ultrarelativistic nuclear collisions.** Heinz, U. (Regensburg Univ. (Germany)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The transverse momentum (p_T) spectra of various hadron species measured at Brookhaven in 14.5 A GeV Si+Au collisions and at CERN in 200 A GeV O+Au and S+Al collisions, are integrated in terms of a superposition of local thermal and global collective expansion at the point of particle freeze-out. Comparing spectra of particles with different masses allows for a separation of the thermal and flow components and thus a separate determination of the freeze-out temperature and the expansion velocity. By varying the initial energy and baryon density of the fireball, a particular initial fireball state was identified which simultaneously explains all the observed p_T spectra. (Z.S.) 5 figs., 20 refs.

20104 (INIS-mf–13194, pp. 138-150) **Soft leptons and photons - a selective review.** Thompson, J.A. (Pittsburgh Univ., PA (United States)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

While the high transverse momentum (greater than 2 GeV/c) production of "hard" direct photons is well explained by the perturbative calculations of three dominant processes, viz., Compton scattering, annihilation and bremsstrahlung, the very low transverse momentum (less than approximately 0.5 GeV/c) remains a puzzle. Soft particles are not easily measured unambiguously; soft processes require non-perturbative methods and are sensitive to final state interactions and radiative corrections. The major experiments, both completed and pending (low transverse momentum photon production experiments and electron and muon pair experiments), are reviewed in the context of current theoretical ideas, and an exhaustive list of references is given in the following subject groupings: photon experiments, "softy" photon theory, lepton pair experiments, single electron low P_t experiments, Bratislava soft annihilation calculations, pion interferometry, background normalization, and other relevant theory. Sensitivity of the results to background subtraction is discussed. (Z.S.) 3 tabs., 52 refs.

20105 (INIS-mf–13194, pp. 183-202) **The new physics on $\gamma\gamma$- and γe-colliders.** Ginzburg, I.F. (AN SSSR, Novosibirsk (USSR). Inst. Matematiki); Serbo, V.G. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility has already been shown of transforming the future linear e^+e^-colliders into $\gamma\gamma$- and γe-colliders with approximately the same energies and luminosities. Experiments on these colliders are discussed which could be used for the observation of new particles and interactions in the TeV region. Particularly discussed are W-physics, "new" W-bosons, the possibility to test the nature of mass in the standard theory by means of the t-quark production, Higgs production - both in the standard model and in models with new contact interaction, superparticles, leptoquarks, composite particles (e.g. scalar, excited electrons,...), strong interaction in the Higgs sector. (author) 1 tab., 4 figs., 11 refs.

20106 (INIS-mf–13194, pp. 117-127) **The decay $\tau \to 3\pi\nu_\tau$ and characteristics of a_1 meson.** Ivanov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR)); Osipov, A.A.; Volkov, M.K. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

In case of the $\tau \to 3\pi\nu_\tau$, the transition caused by the weak axial-vector hadronic current can be described by a resonant formula of the Breit-Wigner type. It contains all information on the interaction of decay products and has a pole corresponding to the a_1 meson contribution. For the construction of functions of the Breit-Wigner type, the quark model of superconductivity type (QMST) was used. The $a_1 \to \pi\rho$ meson vertex structure was studied on the basis of its connection with a number of related processes, e.g., the radiative decays $a_1 \to \pi\gamma$ and $\pi \to e\nu\gamma$. (Z.S.) 2 tabs., 4 figs., 27 refs.

20107 (INIS-mf–13194, pp. 242-248) **About decays of light mesons into lepton pairs: three-dimensional theory and phenomenology.** Kozlov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Probabilities of the decays of η, K_L into lepton + antilepton were calculated within a quark-loop model with a relativistic quark-meson vertex function. An exact QCD modification was proposed for the confinement interaction. In constructing a possible mechanism of interaction between quarks in quarkonium, the effective kernel of confinement was assumed to be characterized by the same color and spin dependence for one-gluon exchange and an r^2-behavior of the interaction potential. (Z.S.) 3 tabs., 11 refs.

20108 (INIS-mf–13194, pp. 342-349) **Entropy scaling and multifractal analysis of multiplicity distributions.** Simak, V. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Sumbera, M.; Zborovsky, I. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Entropy scaling of multiplicity distributions is reviewed and shown to be a special case of a more general set of multifractal measures. As an example the energy dependence of the maximum of multiplicity distribution is discussed. (author) 4 figs., 15 refs.

20109 (INIS-mf–13194, pp. 308-312) **$K_L \to \pi^0 e^+e^-$ and CP-violation.** Pich, A. (Valencia Univ. (Spain). Dept. de Fisica Teorica). Slovenska Akademia Vied, Bratislava (Czechoslovakia).

Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The $K_L \to \pi^0 e^+ e^-$ decay appears to be an ideal candidate to look for new signs of CP violation within the standard model. The present state of theoretical predictions on this decay mode, both for CP-violating and CP-conserving contributions, is reviewed. (author) 2 figs., 14 refs.

20110 (INIS-SU–312, pp. 35-54) **Physics of nucleon resonances and pion photoproduction $\gamma N \to N\pi$.** Barannik, V.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Kulish, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

Nucleon resonances are considered as systems consisting of three quarks; four quarks and one antiquark; three quarks and one gluon as well as excitation of pion field in soliton models. Mutipole analyses of pion photoproduction on nucleons are discussed and the results of determining spiral amplitudes of nucleon resonance photoexcitation are presented. A problem of full-scale experiment design for more accurate determination of photoexcitation amplitudes of nucleon resonances and for search of hybrid baryons is considered. Observables corresponding to two polarized particles in the reactions of photoproduction of charged and neutral pions on nucleons at photon energy from 250 to 1160 MeV are presented. 64 refs.; 7 figs.; 4 tabs.

20111 (IS-T–1586) **A study of isolated photons in Z^0 hadronic decays using the DELPHI detector at LEP.** Holmes, R. Ames Lab., IA (United States). 25 Feb 1992. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012583. Source: OSTI; NTIS; INIS; GPO Dep.

We present a study of the production of energetic isolated photons in the reaction $e^+e^- \to Z^0 \to q\bar{q}\gamma$ using the DELPHI detector at LEP. Within the context of the Standard Model, our results for final state radiation show no evidence for anomolous photon production due to rare or new processes. We present a comparison of our data with these theoretical expectations or present upper limits at the 95% CL on the cross section times the branching ratio to hadrons and a photon for the rare or new processes: (1) σ $(e^+e^- \to Z^0 \to H^0\ \gamma) \cdot \mathrm{BR}\ (H^0 \to q\bar{q})$; (2) σ $(e^+e^- \to Z^0 \to q\ q^*) \cdot \mathrm{BR}\ (q^* \to q\ \gamma)$; (3) σ $(e^+e^- \to Z^0 \to Z^*\ \gamma) \cdot \mathrm{BR}\ (Z^* \to q\bar{q})$.

20112 (ITF–89-46) **High-energy elastic scattering of polarized photons.** Jenkovszky, L.L.; Sergeev, V.S.; Struminskij, B.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 8p. (In Russian). Order Number DE92627303. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of a Regge-type model it is shown that agreement with the polarization data in pp scattering requires the contribution from the anomalous chromomagnetic moment of the pomeron. 6 refs.

20113 (ITP–89-76) **Hadronic processes with large transfer momenta and quark counting rules in multiparticle dual amplitude.** Akkelin, S.V.; Kobylinskij, N.A.; Martynov, E.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 24p. Order Number DE92627304. Source: OSTI; NTIS (US Sales Only); INIS.

A dual N-particle amplitude satisfying the quark counting rules for the processes with large transfer momenta is constructed. The multiparticle channels are shown to give an essential contribution to the amplitude decreasing power in a hard kinematic limit. 19 refs.; 9 figs.

20114 (ITP–90-42) **Asymptotic behaviour of a rescattering series for nonlinear reggeons.** Akkelin, S.V.; Martynov, E.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 13p. Order Number DE92627305. Source: OSTI; NTIS (US Sales Only); INIS.

A series of elastic re-scattering (both quasi-eikonal and U-matrix ones) for reggeons with nonlinear trajectories are estimated asymptotically. The calculations are performed for models of supercritical and dipole pomerons. A weak dependence of the series of re-scattering on reggeon trajectory nonlinearity is revealed. 13 refs.; 3 figs.

20115 (KEK-PROC–91-8, pp. 84-93) **Analytical approach to single selectron production.** Jimbo, Masato (Fujita Health Univ., Toyoake, Aichi (Japan)); Katuya, Mituaki. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. (CONF-9008241–: KEK summer institute on high energy phenomenology, Tsukuba (Japan), 21-25 Aug 1990). In *Proceedings of the KEK summer institute on high energy phenomenology.* 145p. Order Number DE92782188. Source: OSTI; NTIS (US Sales Only); INIS.

Analytical cross section formulae for the single selectron production in electron-positron collisions are proposed by using the real photon approximation and by keeping the photino mass. (author).

20116 (LA–12262-T) **Measurement of neutrino electron scattering and inverse beta-decay of carbon using neutrinos from stopped muon decay.** Krakauer, D.A. Los Alamos National Lab., NM (United States). Apr 1992. 244p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011451. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis was submitted to University of Maryland.

Electron-neutrino electron elastic scattering and two-body electron- neutrino carbon scattering reactions were observed using a 15 ton fine-grained detector and neutrinos from μ^+ decay at rest. The data was obtained during an exposure to neutrinos produced in LAMPF proton beam-stop. Based on identification of 262±46 $\nu_e e^-$ events the total cross-section for $\nu_e e^- \to \nu_e e^-$ was measured to be $\sigma(\nu_e E^-) = (3.09 \pm 0.54(\mathrm{stat}) \pm 0.39(\mathrm{syst})) \times 10^{-43}\ \mathrm{cm}^2$. The interference between the weak charged and neutral currents was measured for the first time. The interference was found to be destructive, with a magnitude 0.97±0.22 times the value predicted by the WSG theory. The total cross-section was also used to measure $\sin^2\theta_W = 0.24 \pm 0.06(\mathrm{stat}) \pm 0.04(\mathrm{syst})$. The data restricts the maximum allowed value of the neutrino magnetic moment to be less than 1.3×10^{-9} Bohr magnetrons for ν_e and 8.8×10^{-10} for ν_{mu}. In a separate analysis, 182±22 ${}^{12}C(\nu_e,e^-)\ {}^{12}N(gs)$ events with subsequent ${}^{12}N(\beta^+)\ {}^{12}C$ were observed, corresponding to a total cross-section, $\sigma(\nu_e\ {}^{12}C \to e^-\ {}^{12}N(gs)) = (1.03 \pm 0.12(\mathrm{stat}) \pm 0.10(\mathrm{sys})) \times 10^{-41}\ \mathrm{cm}^2$. This was the first observation of ν_e-induced transitions between specific nuclear states. The results is good agreement with theoretical predictions.

20117 (MPI-PhE–91-09) **A review of experimental results on intermittency.** Schmitz, N. Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut. Dec 1991. 19p. (CONF-9109221–: 21. international symposium on multiparticle dynamics, Wuhan (China), 23-27 Sep 1991). Order Number DE92516501. Source: OSTI; NTIS (US Sales Only); INIS.

After discussing in the Introduction some more recent developments in the field of intermittency in multiparticle production, results are presented from the various experiments on the following topics: factorial moments, regularities of intermittency indices, dependence on multiplicity, dependence on transverse momentum, Ochs-Wosiek relation, comparison with models, and factorial correlators. (orig.).

20118 (PHE–91-09) **Leptoquark production at linear colliders.** Bluemlein, J. (Institut fuer Hochenergiephysik, Zeuthen (Germany)); Rueckl, R. Institut fuer Hochenergiephysik, Zeuthen (Germany). Dec 1991. 8p. Contract BMFT 055ZT91I-01. (CONF-9109328–: Physics with e^+e^- linear colliders, Hamburg (Germany), 2-4 Sep 1991; MPI-Ph–91-107). Order Number DE92516978. Source: OSTI; NTIS (US Sales Only); INIS.

The production of scalar and vector leptoquarks is studied in e^+e1- annihilation in the energy range of future linear colliders. We assume general dimensionless $SU_c(3)xSU_L(2) \times U_y(1)$ invariant couplings conserving baryon and lepton number. At integrated luminosity of L = 10 fb^{-1} such leptoquarks can be observed nearly up to the phase space limit. Furthermore, scalar and vector leptoquarks can be distinguished by the angular distributions. (orig.).

20119 (PHE–91-014) **Structure functions and low Q^2 physics at HERA.** Roeck, A. de (Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut fuer Physik); Klein, M. Institut fuer Hochenergiephysik, Zeuthen (Germany). Dec 1991. 24p. Contract BMFT 05-5ZT91I/01. (CONF-9109330–: Hadron structure '91, Stara Lesna (Czechoslovakia), 16-20 Sep 1991). Order Number DE92516790. Source: OSTI; NTIS (US Sales Only); INIS.

Important new insights into the hadron structure are expected from the data which will be collected at the electron-proton storage ring HERA at DESY, Hamburg. In this paper the physics opportunities for cross section related measurements at HERA are reviewed. Emphasis is put on the derivation of the proton structure functions, on the QCD effects expected in the newly accessible low χ region and on almost real photoproduction physics. (orig.).

20120 (PITHA–91/18) **Cross-sections and masses of the intermediate vector bosons in UA1.** Boehrer, A. Technische Hochschule Aachen (Germany). Lehrstuhl fuer Experimentalphysik 3A und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Oct 1991. 125p. Order Number DE92516575. Source: OSTI; NTIS (US Sales Only); INIS.

In this analysis we study the cross-sections of $W^{\pm} \rightarrow \mu^{\pm}\nu$ and $Z^0 \rightarrow \mu^{+}\mu^{-}$ and the masses of the intermediate vector bosons in panti p collisions. Related subjects, such as the total width of the $W^{\pm}$, which test the Standard Model are discussed. (orig.).

20121 (RAL–91-085) **Scalar mesons and kaons in ϕ radiative decay and their implications for studies of CP violation at DAϕNE.** Brown, N.; Close, F.E. Rutherford Appleton Lab., Chilton (United Kingdom). Dec 1991. 16p. Order Number DE92627311. Source: OSTI; NTIS (US Sales Only); INIS.

We had become interested in the possibility that radiative decays of the ϕ meson might be so prominent that they would undermine the primary aim of the ϕ factory, namely the study of (CP) charge-parity violation. As a result of previous work we can now be confident that the CP programme will not be significantly affected by this possibility. At the same time, the DAϕNE facility will create opportunities for studying ϕ radiative processes, in particular the production of the enigmatic scalar resonances, in their own right. (author).

20122 (RAL–91-090) **Remarks on the exotic U-meson.** Chan Hongmo (Rutherford Appleton Lab., Chilton (United Kingdom)); Tsou Sheungtsun. Rutherford Appleton Lab., Chilton (United Kingdom). Dec 1991. 9p. Order Number DE92627312. Source: OSTI; NTIS (US Sales Only); INIS.

In expectation of imminent results from the new hyperon beam experiment at CERN concerning the exotic U-meson at 3.1 GeV, we propose a detailed program of experimental tests to check the suggestion that U is a qqq-barq-bar "M-diquonium" state. Apart from some very characteristic decay modes, the U is expected to occur together with several analogous states with various quantum numbers to which it is intimately related. (author).

20123 (RAL–92-004) **Pole counting and resonance classification.** Morgan, D. Rutherford Appleton Lab., Chilton (United Kingdom). Jan 1992. 15p. Order Number DE92628526. Source: OSTI; NTIS (US Sales Only); INIS.

S-wave resonances occurring close to an inelastic threshold can be classified according to the number of nearby poles they possess. One then has a useful possibility of distinguishing dynamical alternatives by objective appeal to data. Making this quantitative entails developing suitable effective range expansions for various realizations of potential scattering. A key application is deciding the make-up of f_0 (976) (S^*). (author).

20124 (SLAC–378, pp. 1-34) **Z decays and tests of the standard model.** Cahn, R.N. (Univ. of California, Berkeley (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Fundamental aspects of Z decays are reviewed. The effects of radiative corrections, both from ordinary QED and from the electroweak interactions are considered from an elementary point of view, but in some detail. The possibility of mixing with an extra Z boson and the effect that technicolor might have are discussed. Additional information that will be obtained from measurements of the W in collider experiments is considered.

20125 (SLAC–378, pp. 97-122) **Studies of the interactions of electroweak gauge bosons.** Burke, D.L. (Stanford Univ., CA (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Exploration of the electroweak interactions of quarks and leptons has ascended along the energy frontier for the past two decades, and has recently culminated the elegant results obtained with the SLC and LEP electron-positron colliders operating at the Z^0. The SU(2) isospin symmetry of the fermion sector is nearly completely known. It remains to uncover the top quark, and determine the precise relationship between the electroweak eigenstates and those of the mass operator embodied in the Cabibbo-Kobayashi-Maskawa formalism. While the authors parameterization of the fermion sector of nature is becoming increasingly clear, they have no empirical knowledge of the interactions and possible structures of gauge bosons (with the exception, of course, of the massless photon). In this series of lectures they will review the origins of the interactions between gauge bosons that exist within the Standard Model, and explore signatures of new physics that might appear in the gauge-boson sector. Special attention will be given to pair-production of gauge bosons in e^+e^- annihilation at center-of-mass energies above those available at LEP II, and to scattering processes that could possibly be studied at very high energy e^+e^- and hadron colliders in the next century.

20126 (SLAC–378, pp. 199-237) **Experimental aspects of B physics.** Drell, P.S. (Cornell Univ., Ithaca, NY (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The first experimental evidence for the existence of the b quark came in 1977 from an experiment at FNAL in which high energy protons were scattered off of hadronic targets. A broad resonance, was observed in the plot of the invariant mass of muon pairs seen in a double armed spectrometer. The width of the resonance was greater than the energy resolution of the apparatus and the data were interpreted as the three lowest lying quark anti-quark bound states of a new quark flavor: b flavor, which stands for either beauty or bottom. The $b\bar{b}$ bound states were called the Υ, Υ', and Υ''. The Υ(1S), Υ(2S) and Υ(3S) and the other bound states of the $b\bar{b}$ system are interesting objects. By studying the energy splitting and decay modes (much like an atomic physicist studies the spectrum of an atom) one learns a great deal about the QCD potential that binds the quarks. However, the authors interest will be in center of mass energies of the Υ(4S) and beyond, where there is sufficient energy to make B mesons: mesons made from a b quark and a light quark, and which carry the b quantum number. The organization of these notes will be as follows: first the author will discuss the basic properties of the B mesons: how they are produced and where; basic features of B decay; and basic properties of the mesons such as mass, lifetime, and spin. In the next section, he will concentrate on the semi-leptonic decays and of the B mesons, which is a very rich field from which a great deal of information has been gleaned, and he will discuss the measurements of the CKM matrix elements that can be made with B mesons. The final chapter will try to look into the future.

20127 (SLAC–378, pp. 259-272) **Rare kaon decays.** Ritchie, J.L. (Univ. of Texas, Austin (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Recent experiments on rare kaon decays are described, with emphasis on the program at the Brookhaven National Laboratory Alternating Gradient Synchrotron. New limits on the modes $K_L \rightarrow \mu e$ and $K_L \rightarrow ee$ and a preliminary new measurement of the $K_L \rightarrow \mu\mu$ branching ratio are presented from AGS Experiment 791. Other modes, including $K^+ \rightarrow \pi^+\mu^+e^-$, $K^+ \rightarrow \pi^+$ + nothing, and $K_L \rightarrow \pi^0 e^+e^-$, which have been the focus of other AGS experiments, are also discussed.

20128 (SLAC–378, pp. 273-286) **CP- violation in K^0 - Decays at CERN.** Holder, M. (Univ. Siegen (West Germany)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Two experiments will be discussed, NA31 and CP-LEAR. The main results of NA31 on CP- and CPT-violation will be reviewed. A recent measurement of the decay $K_L \rightarrow \pi^0\gamma\gamma$, which has some relevance for CP-violation in the decay $K_L \rightarrow \pi^0 e^+e^-$, will be presented in some detail, and a new proposal for a more precise measurement of ϵ'/ϵ will be outlined. For CP-LEAR the aims of the experiment and a brief status report will be given.

20129 (SLAC–378, pp. 287-303) **Recent K^0 decay results from Fermilab E-731.** Barker, A.R. (Univ. of Chicago, IL (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The status of the E-731 experiment is reviewed. In addition, preliminary results are reported from searches for three rare decays of the K^0, using data collected by the E-731 Collaboration during the 1987-88 fixed-target run at Fermilab. Branching ratio results are presented for the decays ${K_{L,S}}^0 \rightarrow \pi^+\pi^-\gamma$, as well as for the decay ${K_L}^0 \rightarrow \pi^\pm\pi^0 e^\mp \nu(\bar{\nu})$. An upper limit is derived for the decay $\pi^0 \rightarrow e^+e^-$, using the processes ${K_L}^0 \rightarrow \pi^0\pi^-\pi^0$ to tag π^0 mesons.

20130 (SLAC–378, pp. 319-328) **Review of recent results on heavy flavor production.** Kwan, S. (Fermi National Accelerator Lab., Batavia, IL (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Recent experimental results on photo- and hadroproduction of heavy flavor particles are reviewed. After a short introduction on the recent advances in the theoretical ideas describing the production of heavy flavors, current experimental techniques used in heavy flavor search in fixed target experiments are briefly discussed. New results on the production characteristics, production cross section and on the A-dependence of the open and hidden charm cross section are presented.

20131 (SLAC–378, pp. 329-336) **Weak matrix elements and the determination of the weak mixing angles.** Wise, M.B. (California Inst. of Tech., Pasadena (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

In the limit of QCD where heavy quark masses go to infinity new symmetries appear which enable one to predict the hadronic form factors that occur in the semileptonic decays $\bar{B} \rightarrow De\bar{\nu}_e$, $\bar{B} \rightarrow D^*e\bar{\nu}_e$ and $\Lambda_c e\bar{\nu}_e$. These results may eventually improve our ability to extract the weak mixing angles from experimental data on $\bar{B}$ and Λ_b decay.

20132 (SLAC–378, pp. 357-373) **Recent results from ARGUS.** Kapitza, H. (Carelton Univ., Ottawa, Ontario (Canada)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Some recent results are reported from the ARGUS experiment, operated at the e^+e^- storage ring DORIS II at DESY. In an updated analysis of semileptonic $b \rightarrow u$ decays direct evidence for such transitions was obtained through reconstruction of a complete event. A study of the lepton energy spectra in $\tau^- \rightarrow e^- \nu\bar{\nu}$ and $\tau^- \rightarrow \mu\, \nu\bar{\nu}$ decays yielded a value for the Michel parameter which is in good agreement with a standard V - A coupling at the τ-ν_τ-W vertex. A parity violating asymmetry was measured in τ decays into three charged pions which shows that the τ neutrino has negative helicity. The Micro Vertex Drift Chamber was installed as a new hardware component of the ARGUS detector. Initial results concerning backgrounds and chamber performance are presented.

20133 (SLAC–378, pp. 375-381) **Neutrino lepton physics with the CHARM2 detector.** Dore, U. (Univ. La Sapienza, Roma (Italy)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The CHARM2 detector has been designed to obtain a precision determination of the electro-weak mixing parameter sin $2\theta_W$ via a measurement of the ratio of the cross section of the purely leptonic neutral current processes $\nu_\mu + e \rightarrow \nu_\mu + e$ and $\bar{\nu}_\mu + e \rightarrow \bar{\nu}_\mu + e$. The main difficulties for the study of these processes come from that very small value of the cross section and from the high level of background. The single electron events produced in the $\nu_\mu - e$ scattering must be extracted from the deep inelastic neutrino nucleon scattering ones that have a three order of magnitude higher rate. To match these requirements CHARM2 [2] has been built as a high mass, low Z, high granularity, sampling calorimeter (total mass 692 tons). The detector has been exposed to the CERN WB neutrino beam starting from 1987. Neutrino and antineutrino runs have been alternated every few days to ensure uniform detector behavior and a total of 2 x 10 19 protons on target have been collected in 87,88,89,90 runs. The analyses that will be presented here refer to 87,88,89 data (75% of the total statistics). The low Z of the target material allows a precise measurement of muon direction, while the high granularity of the detector makes possible a detailed study of vertex activity. These characteristics of the CHARM2 calorimeter together with the muon momentum information have allowed the author to study two leptonic processes in which the neutrino electron interaction gives rise to final states containing only muons and precisely (1) Inverse muon decay $\nu_\mu + e - \rightarrow \mu - +\nu_e$ (2) Muon pair production in the electromagnetic field of a nucleus. $\nu + A \rightarrow \nu + \mu + +\mu - +A$. This process, usually called neutrino trident production, can be seen from the point of weak interactions as $\nu_\mu\mu$ elastic scattering.

20134 (SLAC–378, pp. 383-402) **Recent results from the three TRISTAN experiments.** Itoh, Ryosuke (KEK, Tsukuba (Japan)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Recent results from the three TRISTAN experiments are presented. The measurements of the forward-backward asymmetry are reviewed. The results of QCD studies are discussed on the test of the existence of the triple gluon coupling and on the determination of Λ/MS using a new Monte Carlo. The various studies on the fragmentation are also presented.

20135 (SLAC–378, pp. 453-471) **Electroweak interactions at LEP.** Borgia, B. (Univ. La Sapienza, Roma (Italy)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

Electroweak interaction at LEP are a subject based on a wealth of data, given the success of the CERN e^+e^- storage ring. The author will report on the results from the four experiments, ALEPH, DELPHI, L3 and OPAL after the analysis of about 1/2 of the data collected in 1989 and 1990. The review will cover the electroweak aspects of the process $e^+e^- \to Z^* \to f\bar{f}$ where the fermions can be either quarks or leptons. The analysis of experimental data is based on the determination of the cross section integrated on the solid angle and on the asymmetry of forward-backward leptons in the final state. In this game the knowledge of the center mass energy is fundamental as the determination of the luminosity by which the event rate is normalized to compute the absolute cross section. Therefore a specific attention is given to these subjects.

20136 (UWThPh–1991-44) **Chargino production at LEP 200.** Bartl, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Fraas, H.; Majerotto, W.; Moesslacher, B. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 29 Oct 1991. 22p. (HEPHY-PUB–561-91.). Order Number DE92627294. Source: OSTI; NTIS (US Sales Only); INIS.

We study chargino production and decay in the energy region of LEP 200, exploring the relevant supersymmetry parameter space. We give numerical predictions for the cross sections and for the signatures $l^+ + l^- + p$, l+jet+p, jet+jet+p. New formulae are presented relating chargino masses and couplings to the supersymmetry parameters. (authors).

20137 (ZfK–753) **Estimates of dielectron production in pp and pd reactions at 1-2 GeV.** Kaempfer, B. (Zentralinstitut fuer Kernforschung, Rossendorf (Germany)); Titov, A.I.; Toneev, V.D. Zentralinstitut fuer Kernforschung, Rossendorf (Germany). Dec 1991. 9p. Order Number DE92516506. Source: OSTI; NTIS (US Sales Only); INIS.

Dielectron production rates are estimated in pp and pd collisions at 1-2 GeV. Uncertainties concerning off-shell T-matrix and form factors are discussed, and material is presented which can be compared with experimental data. Measurements of cross sections are needed to get reliable input in theoretical models for heavy-ion collisions. (orig.).

6624 Properties of Specific Particles and Resonances

Refer also to citation(s) 19264, 20006, 20026, 20038, 20049, 20055, 20093, 20120, 20126, 20181, 20236

20138 (ANL-HEP-CP–92-17) **Prospects for long baseline neutrino oscillation experiments.** Goodman, M. Argonne National Lab., IL (United States). [1991]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9111141–7: Workshop on long-baseline neutrino oscillations, Batavia, IL (United States), 17-20 Nov 1991). Order Number DE92011833. Source: OSTI; NTIS; INIS; GPO Dep.

Several recent development have motivated consideration of neutrino experiments located hundreds or thousand of kilometers from an accelerator. The motivations and experimental challenges for such experiments are examined. Three proposals for using the Fermilab Main Injector are compared. The requirements on mass, distance and resolution for an "ideal" detector for such an experimental are considered.

20139 (BNL–46979) **Current status of the E(1420)/ι(1440) and future prospects of the g_T decaying into $\phi\phi$.** Chung, S.U. Brookhaven National Lab., Upton, NY (United States). Dec 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9110318–1: SuperLEAR workshop, Zurich (Switzerland), 9-12 Oct 1991). Order Number DE92011475. Source: OSTI; NTIS; INIS; GPO Dep.

A survey is given of the current status of the $f_1(1420)$/E and the $\eta(1440)/\iota$ in the channels of $K\bar{K}\pi$ and $\eta\pi\pi$. There is now strong evidence that the $\eta(1440)/\iota$ is split into two $J^{PC} = o^{-+}$ states in the 1.4–1.5 GeV range with the lower-mass state coupling mostly to $a_0(980)\pi$ whereas the upper-mass state couples mainly to $K^*(890)\bar{K}$. Both of them cannot be quarkonia. It appears very likely that the $f_1(1420)$/E is an S-wave $K^*(890)\bar{K}$ molecule with a strong overlap with the $a_0(980)/\delta$. It is thought that one or more of the $J^{PC} = 1^{++}$ $f_2(2010)/g_T$, $F_2(2300)/g_T{}'$ and $f_2(2340)/g_T{}''$ states decaying into $\phi\phi$ may be the tensor glueball. The future prospects at BNL and elsewhere for further experimental work on these on other exotic states coupling to $\phi\phi$ are discussed.

20140 (DESY–91-145) **Results on light quark spectroscopy.** Bienlein, J.K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Harjes, J.; Kolanoski, H. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Dec 1991. 27p. (CONF-910864–: 4. international conference on hadron spectroscopy, College Park, MD (United States), 12-16 Aug 1991). Order Number DE92516971. Source: OSTI; NTIS (US Sales Only); INIS.

This report contains a survey article of resonance production by the Crystal Ball Collaboration from J. K. Bienlein, an article on CELLO results for $\gamma\gamma\Pi^*p^{*+-}$- from J. Harjes, a survey article on the production of scalar and tensor mesons in two-photon collisions, and an article on the study of the a_1 resonance by τ decays, the last two articles are both from H. Kolanoski. See hints under the relevant topics. (HSI).

20141 (FNAL/C–92/26A) **The many aspects of neutrino physics.** Frieman, J.A. Fermi National Accelerator Lab., Batavia, IL (United States). Jan 1992. 15p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC02-76CH03000. Grant NAGW-2381. (CONF-9111210–Summ.: Many aspects of neutrino physics; Workshop on long-baseline neutrino oscillations, Batavia, IL (United States); Batavia, IL (United States), 14-17 Nov 1991; 17-20 nov 1991; CONF-9111141–Summ.). Order Number DE92011735. Source: OSTI; NTIS; INIS; GPO Dep.

In mid-November, over seventy physicists gathered at Fermilab for an informal workshop on the Many Aspects of Neutrino Physics, which dovetailed with and also helped lay the groundwork for the succeeding more narrowly focused conference on Long Baseline Neutrino Oscillations. The workshop indeed covered many of the interrelated aspects of neutrino physics: 17 keV neutrinos (experiments, theoretical models, and astrophysical constraints), neutrino properties (double beta decay experiments, neutrino magnetic moments), neutrinos from/as weakly interacting massive particles (WIMPs) in cosmology and astrophysics, atmospheric neutrinos, and solar neutrinos. In the following, I provide a brief and thoroughly biased account of only some of the many interesting developments discussed at the workshop.

20142 (FNAL/C–92/62) **The 17 keV neutrino and neutrino tagging.** Bernstein, R.H. Fermi National Accelerator Lab., Batavia, IL (United States). Feb 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9111141–6: Workshop on long-baseline neutrino oscillations, Batavia, IL (United States), 17-20 Nov 1991). Order Number DE92011281. Source: OSTI; NTIS; INIS; GPO Dep.

P-788 at FNAL proposed to search for neutrino oscillations in a tagged neutrino line. A K_L beam and the decay modes $K_L \to \pi\mu\nu_\mu$ and $K_L \to \pi e\nu_e$ provides the neutrino flux. An upstream tagging spectrometer then identifies the hadron and lepton and reconstructs the K_L decay; the lepton identification will specifies the neutrino as ν_e or ν_μ and distinguishes ν from $\bar{\nu}$ at the decay vertex. A neutrino detector modeled after an existing deep-inelastic scattering spectrometer (rates have been worked out for the CCFR apparatus) can be used to associate the K_L with a neutrino interaction, measure the neutrino energy, and analyze outgoing muons. Monte Carlo studies show that 30K ν_e and 20K ν_μ could be obtained in two fixed target runs at the Tevatron.

20143 (IFVE-ONF--91-139) **Search for light neutral scalar and pseudoscalar particles in pFe interactions at 70 GeV.** Anikeev, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Bamburov, N.S.; Bozhko, N.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 25p. (In Russian). Order Number DE92627317. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the Z. Phys.

A search has been performed for weakly interacting neutral light scalar and pseudoscalar particles in a proton beam dump experiment. No positive signal is observed. Limits on the mass and lifetime of these particles are set in the frame of the Standard Model and its minimal supersymmetric extension. The Higgs particle of the SU(2L)xU(1) Standard Model is excluded for masses in the range 1 MeV<m<80 MeV at 95% CL. Limits on the Peccei Quinn like axions are also derived. 33 refs.; 13 figs.; 2 tabs.

20144 (IHEP-OEF--91-11) **On determination of the top quark mass at hadron colliders.** Kiryunin, A.E.; Moiseev, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1991. 43p. Order Number DE92627320. Source: OSTI; NTIS (US Sales Only); INIS.

A study has been made on a possibility to determine the top quark mass at hadron colliders by measuring the jets from its hadronic decay in a calorimeter. For this purpose 5000 events of the channel pp-bar → tt-bar+X → (W$^+$b)(W$^-$b-bar)+X → (qq-barb)(l$^-$$\nu$-barb-bar)+X (and charge conjugated to it) at $\sqrt{s}$=6 TeV has been produced with the ISAJET Monte Carlo program. Some features of top quark production and decay have been analyzed. The factors affecting the multijet invariant mass resolution have been analyzed in detail. It has been found that the bremsstrahlung that comes off the final state partons and background of overlapping gluon jets significantly reduces the precision of jet spectroscopy. A special algorithm of hard jet finding, optimized for top quark searching and measuring its mass in three jet invariant mass distributions, has been developed. As a result it has been shown that the systematic error of the m_t measurement at hadron colliders can not be less than 3 GeV. 16 refs.; 17 figs.; 8 tabs.

20145 (INIS-mf--13192, pp. 127-128) **Properties of and searching for glueballs.** Lanik, J. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Although the possible existence of glueballs as bound states of gluons was suggested as early as the starting stage of quantum chromodynamics, it has so far not been proved experimentally. Experimental evidence of a glueball component in the hadron spectrum would provide a powerful, perhaps decisive, proof of the correctness of quantum chromodynamics as the fundamental theory of strong interactions. Theoretical considerations associated with the search for glueballs and evidencing their properties are summarized. (Z.S.). 16 refs.

20146 (INIS-mf--13192, pp. 248) **Hypernuclear magnetic moments.** Mares, J. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Zofka, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYPERNUCLEI/magnetic moments; HYPERNUCLEI; LAMBDA PARTICLES

20147 (INIS-mf--13192, pp. 247) **Exotic particles in Serpukhov?.** Novak, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELEMENTARY PARTICLES/ serpukhov tevatron; EXOTIC RESONANCES

20148 (INIS-mf--13194, pp. 249-253) **Quantum aspects of chiral soliton.** Fujii, K. (Hokkaido Univ., Sapporo (Japan). Faculty of Science); Sato, K.-I.; Ogawa, N.; Kobushkin, A.P.; Okazaki, T. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The current conservation problem is discussed by applying the quantization procedure for the rotational mode, and the situation is investigated of how the quantum effect appears. (Z.S.) 7 refs.

20149 (INIS-mf--13194, pp. 313-318) **Absence of strange quarks in nucleons.** Scadron, M.D. (Arizona Univ., Tucson, AZ (United States). Dept. of Physics). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown in a number of ways that neither the strange quark axial-vector spin Δs=(s-bar$\gamma_\mu\gamma_5$s)$_N$ nor the quark density (s-bars)$_N$ can occur in nucleons. (author) 1 fig., 13 refs.

20150 (INIS-mf--13194, pp. 319-322) **Why the ratio m_s/ $m_{aver}\approx$25 and scale $m_{aver}\approx$5 Mev are suspect.** Scadron, M.D. (Arizona Univ., Tucson, AZ (United States). Dept. of Physics). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The standard current quark mass ratio $m_s/m_{aver}\approx$25 Mev and scale $m_{aver}\approx$5 MeV does not explain (i) the observed ratio $f_K/f_\pi\approx1.25$, (ii) the empirical nucleon σ term of 60 MeV, (iii) the chiral-limiting nucleon mass of ≈900 MeV, and (iv) the small observed 5% Goldberger-Treiman discrepancy. (author) 10 refs.

20151 (INIS-mf--13194, pp. 329-335) **On contribution of instantons to nucleon sum rules.** Dorokhov, A.E. (Joint Inst. for Nuclear Research, Dubna (USSR)); Kochelev, N.I. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The contribution of instantons to nucleon QCD sum rules is discussed. The nucleon mass is proportional to the inverse size of the instanton $1/\rho_c$. The agreement between the mass obtained by calculation and by experiment testifies that the effective size of instantons in the QCD vacuum corresponds to the instanton liquid model with $\rho_c \approx 1.6$ Gev^{-1}. It is shown that the contribution of instantons does not provide a stabilization of the sum rules and leads to the formation of the nucleon as a bound state of quarks in the instanton field. Thus the QCD sum rules confirm the conclusion about the dominant role of instanton-induced interactions in the hadron spectroscopy obtained earlier within the quark model. (Z.S.) 3 figs., 17 refs.

20152 (INIS-mf--13194, pp. 336-341) **Instantons and EMC-effect for spin-dependent function $g_1{}^p(x)$.** Dorokhov, A.E. (Joint Inst. for Nuclear Research, Dubna (USSR)); Kochelev, N.I. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the polarization contribution of the instanton vacuum of QCD gives a 70% contribution to the nucleon helicity. It is, however, cancelled by the contribution of sea quarks which are polarized against the nucleon spin. (author) 20 refs.

20153 (INIS-mf--13194, pp. 377-386) **Bound states of relativistic particles and Regge trajectories within the potential approach.** Bykov, A.A. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Mironov, A.D.; Royzen, I.I. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The accuracy of the potential description of the bound states of relativistic particles is estimated. A rough potential for two spinless light quark system is proposed in the framework of the Klein-Gordon equation. The general properties of the energy spectrum are outlined analytically, and numerical calculations of quite realistic Regge trajectories are presented. The magnitude of spin corrections is discussed phenomenologically. (author) 2 tabs., 3 figs., 11 refs.

20154 (INIS-mf--13194, pp. 323-328) **Quark masses in heavy quarkonia potential models.** Motz, G. (Humboldt-Universitaet, Berlin (Germany). Sektion Physik); Lewin, K. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

At present a number of potential models exists. In each model the quark masses are introduced as free parameters to be fitted to the data together with those parameters which directly appear in the central nonrelativistic potential. The possibility is discussed of introducing equal constituent quark masses for all models considered. (Z.S.) 1 tab., 17 refs.

20155 (INIS-mf--13194, pp. 366-376) **On confining aspects of relativistic configurational space.** Kagramanov, E.D. (AN Azerbajdzhanskoj SSR, Baku (Azerbaijan). Inst. Fiziki); Nagiyev, S.M.; Mir-Kasimov, R.M. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475--: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

An attempt is presented to show that the confinement phenomenon can be a feature inherent to the theory of strong interactions. The consideration is based on the concept of the relativistic configuration space. (Z.S.) 16 refs.

20156 (INIS-SU--312, pp. 55-68) **Quadrupole amplitudes of electromagnetic excitation of Δ-isobar on nucleon.** Kulish, Yu.V. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

A problem of quadrupole amplitudes of $\gamma N \rightarrow \Delta$ and $eN \rightarrow e\Delta$ transitions is considered. The results of computing quadrupole amplitudes in theoretical approaches: dispersion sum rules, nonrelativistic quark models, bag models and soliton models are discussed. The results of determining quadrupole amplitudes which correspond to Δ-isobar production in the processes of photo- and electroproduction of pions on nucleons are presented. 41 refs.; 3 tabs.

20157 (INIS-SU--312, pp. 102-115) **Electromagnetic transition form factor N → Δ(1232).** Gakh, G.I. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

The status of the studies into the determination of electromagnetic form factor of $\gamma' N \rightarrow \Delta(1232)$ transition is reviewed. A procedure of deriving this form factor from experimental data on inelastic scattering of electrons by protons and deuterons is considered. The reaction of Δ-isobar production on deuteron, $d(e, e')\Delta N$, is investigated in depth. 42 refs.; 8 figs.

20158 (ITP--89-56) **New semiclassical approximation for quarkonia Regge-trajectories.** Kobylinskij, N.A.; Stepanov, S.S.; Tutik, R.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 12p. Order Number DE92627321. Source: OSTI; NTIS (US Sales Only); INIS.

A new semiclassical method, complimentary to WKB one, used to derive quarkonia Regge-trajectories within the Schroedinger equation is proposed. Based upon the $\hbar$-expansion, the simple recursion formulas are presented. The results computer for some confinement potentials illustrate the speed and accuracy of the technique. 14 refs.; 3 tabs.

20159 (ITP--90-34) **New approach to electromagnetic signals from quark-gluon plasma.** Makhlin, A.N. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 25p. Order Number DE92627322. Source: OSTI; NTIS (US Sales Only); INIS.

The sources of discrepancies of different calculations of the dilepton emission rate from quark-gluon plasma are analyzed. The analysis proceeds from the first principles and at this level the roots of discrepancies are found. The standard renormalization procedure is shown to be ill suited for relativistic thermal theories. A new approach based on the scale invariance of neutral QGP is proposed. 15 refs.

20160 (ITP--90-78) **Uniterization of supercritical pomeron and odderon.** Akkelin, S.V.; Martynov, E.S. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 8p. Order Number DE92627323. Source: OSTI; NTIS (US Sales Only); INIS.

The methods used to unitarize supercritical pomeron and odderon at fixed momenta are considered. The crossing-odd component of the unitarized amplitude is shown to vanich in a power way with energy increase if either intercepts or slopes of the bare pomeron and odderon trajectories are unequal. 6 refs.

20161 (KEK-PROC--91-8, pp. 94-101) **Matrix-form-independent study of three-family quark mass matrices.** Koide, Yoshio (Shizuoka Univ. (Japan). Dept. of Physics). National Lab. for

High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. (CONF-9008241–: KEK summer institute on high energy phenomenology, Tsukuba (Japan), 21-25 Aug 1990). In *Proceedings of the KEK summer institute on high energy phenomenology.* 145p. Order Number DE92782188. Source: OSTI; NTIS (US Sales Only); INIS.

From a matrix-form-independent study of 3 x 3 quark mass matrices, a general sum rule is derived. I would like to talk about my recent work stated above, but more than half of my talk will be devoted to 'Introduction' (the motivation, etc.). (author).

20162 (KEK-PROC–91-8, pp. 102-114) **Where to look for the origin of fermion masses.** Murayama, Hitoshi (Tokyo Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. (CONF-9008241–: KEK summer institute on high energy phenomenology, Tsukuba (Japan), 21-25 Aug 1990). In *Proceedings of the KEK summer institute on high energy phenomenology.* 145p. Order Number DE92782188. Source: OSTI; NTIS (US Sales Only); INIS.

The importance of the search for the origin of the fermion masses at the future e^+e^- linear colliders with $\sqrt{s}$ = 0.5 - 1.5 TeV is emphasized. The process $e^+e^- \rightarrow$tt-barZ^0 serves a good place for the search if the Higgs boson lies above the threshold of its decay into tt-bar, however the background from continuum production is severe for heavy Higgs boson. The process $e^+e^- \rightarrow \nu_e\nu$-bar$_e$tt-bar has smaller cross section, however it is an ideal place to study the effect of the Yukawa coupling for any m_H. Search strategies for the strongly interacting W_L/Z_L/top sector are discussed. (author).

20163 (SLAC–378, pp. 473-487) **Recent results on W - Physics from the UA2 experiment at the CERN $p\bar{p}$ - collider.** Jakobs, K. (CERN, Geneva (Switzerland)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jan 1991. (CONF-900799–: 18. SLAC summer institute on particle physics: heavy quarks and gauge bosons, Stanford, CA (United States), 16-27 Jul 1990). In *Gauge bosons and heavy quarks: Proceedings of Summer Institute on Particle Physics.* 528p. Order Number DE91011248. Source: OSTI; NTIS; INIS.

The UA2 experiment at the CERN $p\bar{p}$ collider has collected large samples of W and Z events during the 1988 and 1989 data taking periods at $\sqrt{s}$ = 630 GeV. These data have been used to measure the production cross sections and the transverse momentum distributions of W and Z bosons and to compare them to QCD predictions. In the framework of the Standard Model, the ratio between and W and Z production cross section has been used to determine the total width of the W boson. A precise measurement of the ratio between the W and Z masses has been extracted, leading to a new determination of the weak mixing angle $\sin^2\theta_w$. A combination of this result with recent measurements of the Z mass at e^+e^- colliders results in a precise absolute measurements of the W mass.

6630 Nuclear Physics

Refer also to citation(s) 19153, 19154

20164 (DOE/ER/40283–T2) **Theoretical studies in nuclear physics: Annual progress report, 1 May 1990–30 April 1991.** Landau, R.H.; Madsen, V.A. Oregon State Univ., Corvallis, OR (United States). [1991]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-86ER40283. Order Number DE92011629. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: Imaginary Optical Potential; Isospin Effects; Scattering and Charge Exchange Reactions; Pairing Effects; $\bar{K}$ Interactions; Momentum Space Proton Scattering; Computational Nuclear Physics; Pion-Nucleus Interactions; and Antiproton Interactions.

20165 (DOE/ER/40328–T1) **[Research in theoretical nuclear physics: Progress report].** Minnesota Univ., Minneapolis, MN (United States). School of Physics and Astronomy. [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER40328. Order Number DE92011221. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following research: dense baryonic matter; photon and dilepton production; intermittency and other correlations; fractional statistics; and electroweak theory. (LSP)

20166 (INIS-mf–13179) **Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).** Kailas, S. (Bhabha Atomic Research Centre, Bombay (India)); Singh, P. (eds.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are indexed separately.

20167 (INIS-SU–312) **Nuclear-physical researches (Theory and experiments): Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989 116p. (In Russian). Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are indexed separately.

20168 (LA-UR–92-926) **Research at LAMPF.** Los Alamos National Lab., NM (United States). Feb 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92011868. Source: OSTI; NTIS; INIS; GPO Dep.

During the past decade, both the science program and the experimental facilities at LAMPF have undergone some significant changes. This report is a concise description of the current research initiatives and of new directions being proposed for the future research program at LAMPF. Traditionally the LAMPF physics program has explored nuclear systems with hadronic probes: pions, protons, and neutrons. In recent years the exploitation of the intense lepton beams – neutrinos and muons – at LAMPF has received increasing emphasis. Explorations of issues in electroweak physics and precision tests of quantum electrodynamics have been significant areas of experimentation. A new concept of the program is an increased emphasis on the role of weak interactions in hadronic systems. Here the electroweak force is treated as a well-understood interaction, which can be used to reveal the wave functions and properties of hadronic systems. The manifestations of the electroweak force may be discussed either in the language of quarks interacting through the exchange of W and Z bosons or in terms of nucleons interacting through the exchange of mesons described by both strong and weak coupling constants. Taken together, these topics provide a rich and vital program of fundamental interest in nuclear physics. Atomic physics, astrophysics, materials research, among others, are additional components of the LAMPF-LANSCE experimental activities. Research highlights of this broad program and the research tools available at LAMPF are described briefly in this report.

6631 Nuclear Structure

Refer also to citation(s) 19314

20169 (ANL/CP–75202) **High field optical-pumping spin-exchange polarized deuterium source.** Zghiche, A. (Argonne National Lab., IL (United States)); Coulter, K.P.; Holt, R.J.; Kinney, E.R.; Kowalczyk, R.S.; Potterveld, D.H.; Young, L.; Zeidman, B.; Toporkov, D.K. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9109356–1: Polarized target workshop, Heidelberg (Germany), 23-28 Sep 1991). Order Number DE92010274. Source: OSTI; NTIS; INIS; GPO Dep.

Recent progress in the performance of laser-driven source of polarized deuterium is described. Optical pumping of potassium atoms followed by spin exchange scattering with deuterium atoms in a high magnetic field and RF transitions in a medium field was found to produce an intense, highly spin-polarized beam of deuterium atoms. In particular, the atomic polarization of deuterium was determined to be 73±3% at an intensity of 2.1 × 10^{17} Atomsis. The RF transition efficiency was measured and found to be 92±5%.

20170 (ANU-P–1089) **Shape co-existence from the structure of the yrast band in ^{174}Pt.** Dracoulis, G.D. (Australian

National Univ., Canberra (Australia). Research School of Physical Sciences); Fabricius, B.; Stuchbery, A.E.; Macchiavelli, A.O.; Korten, W.; Azaiez, F.; Rubel, E.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S. Australian National Univ., Canberra (Australia). Research School of Physical Sciences. Jul 1991. 13p. Order Number DE92627328. Source: OSTI; NTIS (US Sales Only); INIS.

Accepted for publication in Physical Review C.

Excited states in the neutron-deficient nucleus ^{174}Pt have been identified up to spin 14. An irregular yrast sequence was observed beginning with a high $2^+ \rightarrow 0^+$ energy. It can be interpreted as the result of a change from a weakly-deformed ground state band, to a well-deformed rotor, near spin 6. 11 refs., 2 tabs., 4 figs.

20171 (ANU-P–1096) **A shape coexistence interpretation of phenomenology of alignment curves in Os and Re isotopes.** Bark, R.A. Australian National Univ., Canberra (Australia). Research School of Physical Sciences. Jun 1991. 25p. Order Number DE92627347. Source: OSTI; NTIS (US Sales Only); INIS.

Accepted for publication in Journal of Physics G.

A model of shape coexistence, based on an intruder $\pi(h_{9/2})^2$ excitation, previously applied to explain low-frequency upbending phenomena in ^{171}Re and ^{172}Os, is extended to heavier Os and Re isotopes. A phenomenological three-band mixing analysis of the yrast bands of even Os nuclei and the $5/2^+[402]$ and $9/2^-[514]$ bands of the neighbouring Re isotopes is used to deduce the excitation energies of the proposed intruder configuration as a function of neutron number. These are shown to be qualitatively consistent with an $(h_{9/2})^2$ excitation. The implications of this model for other nuclei are discussed. 53 refs., 1 tab., 7 figs.

20172 (CONF-9205108–1) **On the question of spin fitting and quantized alignment in rotational bands.** Baktash, C. (Oak Ridge National Lab., TN (United States)); Nazarewicz, W.; Wyss, R. Oak Ridge National Lab., TN (United States). [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International conference on nuclear structure at high angular momentum; Ottawa (Canada); 18-21 May 1992. Order Number DE92011063. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. DEFORMED NUCLEI/rotational states; SPIN; ANGULAR MOMENTUM; ALIGNMENT; GAMMA RADIATION

20173 (CONF-9205108–3) **Lifetimes of low spin states in the superdeformed band of ^{192}Hg.** Lee, I.Y. (Oak Ridge National Lab., TN (United States)); Baktash, C.; Cullen, D.M.; Garrett, J.D.; Johnson, N.R.; McGowan, F.K.; Winchell, D.F.; Yu, C.H. Oak Ridge National Lab., TN (United States). [1992]. 1p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International conference on nuclear structure at high angular momentum; Ottawa (Canada); 18-21 May 1992. Order Number DE92011066. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. MERCURY 192/nuclear deformation; LIFETIME; SPIN; GAMMA SPECTRA

20174 (DOE/ER/40159–182) **The structure of nuclei far from beta stability: Progress report, May 15, 1991–May 14, 1992.** Zganjar, E.F. Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Physics and Astronomy. [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER40159. Order Number DE92012598. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: shape coexistence and intruder states; the electric monopole transition in nuclei; gold isotopes; platinum isotopes; iridium isotopes; search for superdeformation in ^{192}Hg; search for population of superformed states in ^{194}Pb using ^{194}Bi β^+-decay; detailed nuclear structure studies far from stability; prototype internal pair spectrometer; and picosecond lifetime spectrometer.

20175 (INIS-mf–13179, pp. 68-87) **Structure of high spin states in nuclei near the closed shell.** Mukherjee, P. (Saha Inst. of Nuclear Physics, Calcutta (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Microscopic structure of high spin states in deformed nuclei is yet to be understood both experimentally and theoretically. However, for nuclei near the closed shell the structure of the high spin states is known to be pure shell model states involving a few valence nucleons. A critical survey of the transitions from high spin states in region starting from Po to Ra indicate complete absence of any E2 collective transitions, so characterisitic of the deformed nuclei. A challenging experimental problem is to identify the onset for such E2 collectivity in these region. (author). 10 refs., 3 figs., 6 tabs.

20176 (INIS-mf–13179, pp. 88-103) **Recent developments in high spin states.** Rath, A.K. (Institute of Physics, Bhubaneswar (India)); Praharaj, C.R. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

High spin states have been an area of active research in the last ten years. Availability of high quality heavy ion beams and precision multielement detector arrays has resulted in the identification of very high spin states with super-collective E2 transition rates. Hosts of new bands have been identified and electromagnetic transition rates are now known with great accuracy. Some of these findings are difficult to understand in the traditional models. These developments and the possible theoretical models which can enhance understanding of these new experimental findings are reviewed. Microscopic models dealing with signature effects, violation of K selection rules and superdeformed bands are discussed. (author). 31 refs., 6 figs., 2 tabs.

20177 (INIS-mf–13179, pp. 175-186) **Signatures of parity mixing among the nuclear states.** Saha, S. (Tata Inst. of Fundamental Research, Bombay (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Space-time invariance properties of the strong, electromagnetic and weak interactions have been questioned and put to rigorous tests for the last 30 years since the breakdown of parity symmetry was observed in the leptonic weak decays. Although the symmetry violations in the leptonic and the semileptonic processes are well understood and good agreement between theory and experiments are found, it is still an open problem in the nonleptonic sector where evidences of parity mixing of the nuclear states are found in the heavier systems but considerable challenge exists in the theoretical interpretations of these data. On the other hand, significant progresses have been made in the theoretical estimates of the observables of parity mixing in lighter systems, but the experimental results are still not conclusive enough to verify these predictions. In this presentation, an overview of the theories of parity mixing for the systems ranging from the lightest to the heavier nuclei is discussed followed by a review of the relevant experiments to extract the extent of parity mixing in these systems. A side by side comparison of the experimental results and the theoretical estimates is made next and finally, the recent progresses and future directions in this field are discussed. (author). 23 refs., 1 fig., 2 tabs.

20178 (INIS-mf–13179, pp. 104-121) **Superdeformation in the A≈190 region.** Garg, Umesh (Notre Dame Univ., IN (United States). Dept. of Physics). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Following the initial discovery, with the Argonne-Notre Dame γ-ray facility, of a superdeformed band (SD) in the nucleus ^{191}Hg, an enormous amount of experimental and theoretical work has been performed in this region in a relatively short period. SD bands have since been established in at least ten nuclei viz. sup(189- 194)Hg, sup(193,194)Tl, and sup(194,196)Pb and the present understanding can be summarized as follows: (1)All data currently available support the interpretation that ^{192}Hg is a 'doubly magic' SD nucleus, i.e. large shell gaps exist for Z=80 and N=112 at a deformation of $\beta_2 \approx 0.55$. (2)For the lighter Hg isotopes, the SD well becomes increasingly shallower and ^{189}Hg is most likely the last SD nucleus in this region. (3)The dynamic moment of inertia as a function of rotational frequency shows a gradual increase (by almost 40%) in most bands. This increase can be attributed to the alignment of pairs of nucleons in high-j intruder orbitals. (4)Recent data on ^{193}Hg provide indications that octupole degrees of freedom play an important role in the SD minimum. (5)As in the A=150 region, SD bands with energies very similar (within 1-2 keV) have been found in the neighboring nuclei: the excited bands of ^{191}Hg have 'twins' in ^{193}Hg. This has been explained in terms of intrinsic spin alignment and pseudo-spin symmetry. Details of some of these results are presented. (author). 19 refs., 10 figs., 1 tab.

20179 (INIS-mf–13179, pp. 122-138) **Recent development in dynamic deformation theory.** Gupta, J.B. (Ramjas Coll., Delhi (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The version-I of the Dynamic deformation theory (DDT-1) of Kumar-Baranger (1968) for the collective nuclear structure of atomic nuclei combines the Pairing-Plus-Quadrupole (PPQ) approxmation of nuclear force, the time-dependent Hartree-Bogoliubov (TDHB) method and the deformed quasi-particle (DQP) basis. A configuration space of two complete oscillator shells each for protons and neutrons, and the active nucleon space of (Z-40), (N-70) is employed in the deformed shell model approach. The later version DDT-2 employs all harmonic oscillator shells and treats all nucleons as active. The method is based on the Bohr-Mottelson unified collective model, but the restriction to axial symmetry and the adiabatic treatment of uncoupled rotation-vibration degrees of freedom is not employed. Instead, complete freedom in β-γ space for each nuclear state is allowed. The 7 parameters of the collective Hamiltonian are derived microscopically along with the EM operators. The calculation for one nucleus is completed in a few hours on a fast computer (> 10 MHz). The fitting parameters for H_c are restricted to two, one of which varies through 10% and the other within a factor of 2. The DDT-1 also called DPPQ proved very successful in predicting the spherical to deformed shape phase transition, prolate to oblate shape transition and the superfluid to normal phase transition, as illustrated by KB for the W -Os -Pt region. In the last two decades, Kumar and Gupta have demonstrated extensively the usefulness of DDT-1 for the Nd-Sm-Gd-Dy nuclei for predicting shape phase transitions, static and transition moments and interband transitions upto 10 collective bands in a individual nucleus where ample experimental data are available. (author). 35 refs., 2 figs., 1 table.

20180 (INIS-mf–13192, pp. 93-96) **Spin-spin effects and static nuclear deformation.** Hnizdo, V. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Physics). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Effective spin-spin interactions of both the spherical and the tensor kinds, are generated by the quadrupole nuclear reorientation together with the spin-orbit force in the elastic scattering of nucleons from nuclei with static deformation. These effects can contribute significantly to the observed spin-spin cross sections when nuclei with large static deformation are involved. On the other hand, calculations of spin-spin effects produced by quadrupole-quadrupole interactions in the scattering of deformed heavy ions indicate that these effects are not important even when large nuclear deformations are involved. (author). 2 figs., 5 refs.

20181 (INIS-mf–13192 p9-p12) **Physics of mesons and nucleons at extreme pressures and temperatures.** Ripka, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Chiral models are used to describe changes of nucleons and mesons propagating in dense nuclear matter at high pressures and temperatures. Such changes can substantially modify the nuclear equation of state and influence supernova explosions. (author). 3 figs., 9 refs.

20182 (INIS-mf–13194, pp. 277-282) **Characteristics of $dp \to ppp\pi^-$ and $np \to pp\pi^-$reactions and deuteron wave function.** Pastircak, B. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The reactions $np \to pp\pi^-$ and $dp \to ppp\pi^-$ at 1.7 GeV/c/nucleon were compared with the following results: In spite of the general qualitative agreement in reaction products characteristics, differences were observed in momentum spectra tails and in spiral azimuthal angular distributions. The first effect is due to Fermi motion, but the second could only be explained by insufficiency of the usual spectator separation as the slowest nucleon in DRF. Considering the limiting angle of emitted nucleons in the investigated reactions, another spectator definition is introduced using an additional condition posed on the angle of emission. The obtained spectator momentum distribution is well described by deuteron wave functions and only about 1% of events remains for the part of exotic effects. (author) 4 figs., 8 refs.

20183 (INIS-mf–13194, pp. 283-290) **A measurement of the deuteron structure functions from deep inelastic muon scattering at high Q^2.** Nemecek, S. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Preliminary results are presented of a high statistics study of the deuteron structure functions $F_2(x,Q2)$ and R, measured in deep inelastic muon scattering. The analysis is based on 800 000 events after all cuts, recorded at beam energies of 120, 200 and 280 GeV in the kinematic range $0.06<x<0.8$ and 8 $GeV^2<Q^2<280$ GeV^2. Scaling violations observed in the structure function F_2 are in good agreement with predictions of perturbative QCD. The QCD mass scale parameter Λ determined from these data is in good agreement with the authors' previous measurements on carbon and hydrogen targets. From the data the ratio of structure functions of the neutron and the proton is obtained using previous hydrogen results. (author) 5 figs., 13 refs.

20184 (INIS-SU–308/A, pp. 55-59) **Measurements of ^{114}In, ^{123}Te, ^{125}Te, ^{133}Ba, ^{135}Ba, ^{191}Os nuclear magnetic moments.** Miftakhov, N.M. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Rodionov, A.A.; Smirnov, Yu.P.; Fedorov, V.V. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

The work is aimed at measuring the unknown magnetic moments of ^{114}In, ^{123}Te, ^{125}Te, ^{133}Ba, ^{135}Ba, ^{191}Os nuclear states and refinement of the earlier obtained data; at determining the possible systematic errors and means of their elimination. To measure the shifts a crystal-diffraction spectrometer by Koshua allowing one to provide for several meV measurement accuracy, is used. Hyperfine shift measurement results and nuclear level magnetic moment values are presented. 14 refs.; 1 tab.

20185 (INIS-SU–308/A, pp. 60-64) **Two-stage excitation of nuclei in positron annihilation with atomic electrons.** Fedotkin, S.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Two-stage nucleus excitation under positron annihilation by atomic electrons is considered. The cross section in the resonance for ^{115}In equals to $\sigma_R \simeq 10^{-28}$ cm^2 and the effective cross section $\sigma_{ef} \simeq 10^{-32}$ cm^2. The values obtained for σ_{ef} should be considered as evaluations of the nucleus two-stage excitation effect value under positron annihilation, which can be specified in a more realistic calculation. 9 refs.; 1 fig.

20186 (INS–913) **Exotic few-body systems involving unstable particles.** Yamazaki, Toshimitsu. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jan 1992. 14p. Order Number DE92514986. Source: OSTI; NTIS (US Sales Only); INIS.

A new light is shed on anomalously long-lived (narrow-width) few-body systems which involve unstable hadrons such as hyperons, mesons and antiprotons. Σ bound states in few-nucleon systems, deeply-bound pionic atoms and metastable hadronic helium atoms are discussed. (author).

20187 (INS–914) **Lifetime measurement of $_{\Lambda}{}^{4}$H hypernucleus.** Outa, H.; Aoki, M.; Hayano, R.S.; Ishikawa, T.; Iwasaki, M.; Sakaguchi, A.; Takada, E.; Tamura, H.; Yamazaki, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1992. 7p. Order Number DE92515032. Source: OSTI; NTIS (US Sales Only); INIS.

Results are reported on a lifetime measurement of $_{\Lambda}{}^{4}$H formed in ^{4}He (stopped K^-, π^0) reaction. Decay of $_{\Lambda}{}^{4}$H was clearly identified by observing the monochromatic π^0 peak from two-body decay ($_{\Lambda}{}^{4}\mathrm{H} \rightarrow {}^{4}\mathrm{He} + \pi^-$ $p_\pi = 132.9$ MeV/c). The lifetime of $_{\Lambda}{}^{4}$H was determined to be $\tau(_{\Lambda}{}^{4}\mathrm{H}) = 194_{-26}{}^{+24}$ ps from a distribution of time difference between the K^- injection and π^- emission. (author)

20188 (ITP–89-62) **Effective Hamiltonian within the microscopic unitary nuclear model: 1. Coherent-state construction technique for microscopic Hamiltonian.** Filippov, G.F.; Blokhin, A.L. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 25p. Order Number DE92627350. Source: OSTI; NTIS (US Sales Only); INIS.

A technique of projecting the microscopic nuclear Hamiltonian on the SU(3)-group enveloping algebra is developed. The approach proposed is based on the effective Hamiltonian restored from the matrix elements between the coherent states of the SU(3) irreducible representations. The technique is displayed for almost magic nuclei within the mixed representation basis, and for arbitrary nuclei within the single representation. 40 refs.

20189 (ITP–89-63) **Effective hamiltonian within the microscopic unitary nuclear model: 2. The study of sd-nuclei with two valence particles.** Avramenko, V.I.; Blokhin, A.L. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 21p. Order Number DE92627351. Source: OSTI; NTIS (US Sales Only); INIS.

Within the microscopic version of the unitary collective model with the horizontal mixing the effective Hamiltonian for ^{18}O and ^{18}Ne nuclei is constructed. The algebraic structure of the Hamiltonian is compared to the familiar phenomenological ones with the SU(3)-mixing terms which describe the coupled rotational and vibrational spectra. The Hamiltonian, including central nuclear and Coulomb interaction, is diagonalized on the basis of three SU(3) irreducible representations with two orbital symmetries. 32 refs.; 2 figs.; 4 tabs.

20190 (ITP–89-79) **A generating function for the effective Hamiltonians in an extended unitary model.** Avramenko, V.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 24p. Order Number DE92627352. Source: OSTI; NTIS (US Sales Only); INIS.

A generating function of the effective Hamiltonians for the nuclei whose dynamic symmetry group is a direct product SU(3)xSU(3) is constructed. It is shown that the generating function is made up of the operators of the enveloping algebra of group SU(3)xSU(3). The basis of the operators involves both the operators which change the indices of irreducible representations (λ,μ) and those which leave them unchanged. The problem of rotational and vibrational limits to the effective Hamiltonians is studied. 32 refs.

20191 (ITP–90-51) **The boundary condition model for three-particle system and nonzero partial waves.** Grinyuk, B.E.; Simenog, I.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 20p. Order Number DE92627353. Source: OSTI; NTIS (US Sales Only); INIS.

The three-particle bound state problem in the 'boundary condition model' case is solved in the framework of Faddeev integral equations. An interaction in nonzero partial waves is shown to be necessarily taken into account due to its essential role in the model. 8 refs.

20192 (LA-UR–92-742) **The trinucleons: Physical observables and model properties.** Gibson, B.F. Los Alamos National Lab., NM (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920126–2: 13. international conference on few body problems in physics, Adelaide (Australia), 5-11 Jan 1992). Order Number DE92011354. Source: OSTI; NTIS; GPO Dep.

Our progress in understanding the properties of ^{3}H and ^{3}He in terms of a nonrelativistic Hamiltonian picture employing realistic nuclear forces is reviewed. Trinucleon model properties are summarized for a number of contemporary force models, and predictions for physical observables are presented. Disagreement between theoretical model results and experimental results are highlighted.

20193 (LA-UR–92-980) **Nuclear structure calculations for astrophysical applications.** Moeller, P. (Mainz Univ. (Germany). Inst. fuer Kernchemie); Kratz, K.L.; Nix, J.R. Los Alamos National Lab., NM (United States). 13 Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States); Bundesministerium fuer Forschung und Technologie, Bonn (Germany); Deutsche Forschungsgemeinschaft, Bonn (Germany). DOE Contract W-7405-ENG-36. (CONF-9110360–1: Exotic nuclei, South Crimea (USSR), 1-5 Oct 1991). Order Number DE92011495. Source: OSTI; NTIS; INIS; GPO Dep.

Here we present calculated results on such diverse properties as nuclear energy levels, ground-state masses and shapes, β-decay properties and fission-barrier heights. Our approach to these calculations is to use a unified theoretical framework within which the above properties can all be studied. The results are obtained in the macroscopic-microscopic approach in which a microscopic nuclear-structure single-particle model with extensions is combined with a macroscopic model, such as the liquid drop model. In this model the total potential energy of the nucleus may be calculated as a function of shape. The maxima and minima in this function correspond to such features as the ground state, fission saddle points and shape-isomeric states. Various transition rate matrix elements are determined from wave-functions calculated in the single-particle model with pairing and other relevant residual interactions taken into account.

20194 (LBL–31382) **Example of a quantum field theory based on a nonlinear Lie algebra.** Schoutens, K. (State Univ. of New York, Stony Brook, NY (United States). Inst. for Theoretical Physics); Sevrin, A.; van Nieuwenhuizen, P. Lawrence Berkeley Lab., CA (United States). Nov 1991. 42p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant 91-08054;Grant PHY90-21139. (CONF-9105239–2: Conference on gauge theories: past and future, Ann Arbor, MI (United States), 16-18 May 1991; ITP-SB–91-34; UCB-PTH–91/52). Order Number DE92010475. Source: OSTI; NTIS; INIS; GPO Dep.

In this contribution to Tini Veltman's Festschrift we shall give a paedagogical account of our work on a new class of gauge theories called W gravities. They contain higher spin gauge fields, but the usual no-go theorems for interacting field theories with spins exceeding two do not apply since these theories are in two dimensions. It is, of course, well known that ghost-free interacting massless spin 2 fields ('the metric') are gauge fields, and correspond to the geometrical notion of general coordinate transformations in general relativity, but it is yet unknown what extension of these ideas is introduced by the presence of massless higher spin gauge fields. A parallel with supergravity may be drawn: there the presence of massless spin 3/2 fields (gravitinos) corresponds to local fermi-bose symmetries of which these gravitinos are the gauge fields. Their geometrical meaning becomes only clear if one introduces superspace (with bosonic and fermionic coordinates): they correspond to local transformations of the fermionic coordinates. For W gravity one might speculate on a kind of W-superspace with extra bosonic coordinates.

20195 (NEANDC(E)–246/L) **The Bruyeres-le-Chatel discrete level library.** Bersillon, O. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France). Service de Physique Neutronique et Nucleaire); Blachot, J. CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France). Service de Physique Neutronique et Nucleaire. Sep 1991. 26p. Sponsored by CEA, 75 - Paris (France). (INDC(FR)–071/L). Order Number DE92011702. Source: OSTI; NTIS (US Sales Only).

In order to make input data preparation for nuclear reaction model codes less time consuming we have developed at Bruyeres-le-Chatel a system of codes and format which handles discrete levels information (such as excitation energy, spin, parity, gamma decay···). The basic data are taken from the adopted levels, gamma data sets of the ENSDF library. These data are converted by a two step process into data directly usable by model codes. The two programs and the associated data format are fully described in this report.

20196 (OUP–91-29) **On the role of third- and higher-order contributions to the effective interaction for pf-shell nuclei.** Hjort-Jensen, M.; Engeland, T.; Holt, A.; Osnes, E. Oslo Univ. (Norway). Fysisk Inst. Nov 1991. 31p. Order Number DE92628578. Source: OSTI; NTIS (US Sales Only); INIS.

In this work the authors have studied the inclusion of third- and higher-order contributions in perturbation theory to the effective interaction appropriate for the pf-shell. It is concluded that these contributions are important and ought to be carefully analyzed when approximating the effective interaction to a given order. To calculate the nuclear G-≡ matrix a recent version of the Bonn meson-exchange potential model (potential A) and the Paris potential has been employed. The Paris potential is found to yield too little attraction, a result which agrees with findings in the sd-shell. The Bonn A potential reproduces fairly well the data for most JT channels in the mass-42 system. For JT = 10 in the same mass system, however, too much attraction is introduced and the agreement with the data is poor. The implications are discussed. 39 refs., 8 figs., 9 tabs.

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Refer also to citation(s) 19284

20197 (CONF-920113–2) **Dissipation and the population of compound nuclei.** Thoennessen, M. (Michigan State Univ., East Lansing, MI (United States)); Beene, J.R. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant PHY-89-13815. From 8. winter workshop on nuclear dynamics; Jackson Hole, WY (United States); 18-25 Jan 1992. Order Number DE92011681. Source: OSTI; NTIS; INIS; GPO Dep.

The importance of nuclear dissipative efforts on the formation of compound nuclei is studied with the γ-ray decay of the giant dipole resonance (GDR) built on highly excited states. The compound nuclei ^{164}Yb, ^{160}Er, and ^{110}Sn were produced with very mass-asymmetric and with more mass-symmetric target/projectile combinations. The large deviation from statistical model prediction observed in the γ-ray spectra from the more symmetrically formed ^{160}Er and ^{164}Yb can be qualitatively explained within the particle exchange model.

20198 (CONF-920113–3) **The mechanism for the disassembly of excited ^{16}O projectiles into four alpha particles.** Charity, R.J. (Washington Univ., St. Louis, MO (United States). Dept. of Chemistry); Barreto, J.L.; Sobotka, L.G.; Sarantites, D.G.; Stracener, D.W.; Chbihi, A.; Nicolis, N.G.; Auble, R.; Baktash, C.; Beene, J.R.; Bertrand, F.; Halbert, M.; Hensley, D.C.;.Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG02-87ER40316 ;FG02-88ER40406. From 8. winter workshop on nuclear dynamics; Jackson Hole, WY (United States); 18-25 Jan 1992. Order Number DE92011668. Source: OSTI; NTIS; INIS; GPO Dep.

The decay of excited ^{16}O projectiles into the four alpha particle exit channel has been investigated. The projectiles, with bombarding energies of E/A = 35 MeV, were excited through peripheral interactions with ^{159}Tb target nuclei. The distribution of relative angles between the four alpha particles in their center of mass frame was compared to simulations of ^{16}O decay by various mechanisms. The relative angles are found to be consistent with either a disassembly via sequential evaporation of alpha particles or by a prompt disintegration process. The data are not consistent with a sequential decay sequence initiated by the fission of the projectile into two ^{8}Be fragments.

20199 (GSI–92-04) **Study of the chemical behaviour of the element 105 and the decay properties of its isotopes $_{105}{}^{262}$Ha and $_{105}{}^{263}$Ha.** Zimmermann, H.P. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany); Mainz Univ. (Germany). Fachbereich 19 - Chemie und Pharmazie. Feb 1992. 134p. (In German). Order Number DE92517028. Source: OSTI; NTIS (US Sales Only); INIS.

Main topic of the present thesis was the study of the halogenocomplexes of the element 105 in aqueous solution. Single atoms of the isotope ⁻2⁻6⁻2_1_0_5Ha were synthesized in the reaction ⁻2⁻4⁻9Bk (⁻1⁻80,5n) at 99 MeV projectile energy and detected via their spontaneous-fission as well as the α decay of the daughter ⁻2⁻5⁻8Lr. At the whole about five thousand anion and cation exchange separations were performed, whereby in the mean nearly in each twentieth experiment an atom of the ⁻2⁻6⁻2Ha could be detected. In subsequent elutions with 0.5 M HCL/0.01 M HF, with 4 M HCL/0.02 M HF, or with 10 M HCL/0.025 M HF^{262} Ha was detected in the protactinium fraction, in the niobium-protactinium fraction, respectively between the elution positions of the protactinium and the niobium and showed by this each a from tantalum extremely different behaviour. We conclude by this on the formation of oxalohalogeno or hydroxohalogenocomplexes analogous to [NbOCL_4]⁻-, [PaOCL_4]⁻, or [Pa(OH)_2CL_4]⁻-contrarily to the pure halogenocomplexes to tantalum as [TaCl$_6$]. Relativistic MO calculations confirm the strong tendency of the element 105 to the formation of oxohalogenocomplexes. At the for the ⁻2⁻4⁻9Bk (⁻1⁻80,4n) reaction optimal projectile energy of 93 MeV^{263}Ha was doubtlessly detected. It decays with 27⁻+⁻1⁻0_-_7s half-life by α decay (E_α=8.355 MeV, I_α=43%) and by spontaneous fission (I_S_F=57_-_1_5⁻+⁻1⁻3%) with a total kinetic energy of 207 MeV. The in 525 experiments detected 25 atoms of ⁻2⁻6⁻3Ha define a formation cross section of 10 mb. Also for ⁻2⁻6⁻2Ha improved decay data and cross sections are given. (orig./HSI).

20200 (INIS-mf–13179, pp. 28-46) **Exotic nuclear decay by spontaneous heavy ion emission.** Shanmugam, G. (Presidency Coll., Madras (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium* *on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Nuclei with $Z>40$ are metastable with respect to spontaneous decay into two fragments with masses M_1 and M_2 and Q value given by $Q = M(A,Z)-M_1(A_1, Z_1)-M_2(A_2,Z_2)> 0$. When $A_2=4$, alpha decay and the case in which $A_1 \simeq A_2$ corresponds to cold fission are obtained. The intermediate case between these two in which $4<A_2<A_1$, corresponds to exotic decay by spontaneous heavy ion emission. Though many heavy nuclei have $Q>0$ for such decays, the decay rates are undetectably low except for certain combinations correspoding to fragments with nearly closed shells. To choose favourable cases for experimental study, a quantitative model to determine decay rates is required. In developing such a model one has to consider the process to be a very asymmetric fission or a preformation followed by tunneling mechanism. A fission model which contains realistic features has been developed. The merits and limitations of this model are discussed in relation to other theoretical models and experimental results. Future prospects of such a study are dealt with at the end. (author). 24 refs., 3 tabs.

20201 (INIS-mf–13179, pp. 154-174) **Neutrinoless $\beta\beta$-decay using a quark model with relativistic harmonic confinement.** Khadkikar, S.B. (Physical Research Lab., Ahmedabad (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The nuclear double beta decay without neutrino emission would provide evidence for lepton-non-conservation and the Majorana nature of neutrinos or the right handed nature of the weak current or the see-saw mechanism for generating neutrino mass in conjuction with Grand Unification Theoretical (GUT) scenario. The impediments in the large number of investigations in the past decade has been the closure approximation to the nuclear part of the amplitude and uncertainty about recoil effects in addition to the effective coupling constants due to non-elementerity of the nucleon. To avoid these pitfalls, a relativistic quark confinement model is employed to obtain form factors due to hadronic currents in double beta decay. The nuclear part of the form factor is evaluated in quasi-particle neutron-proton random phase approximation. The double beta decay amplitude formula is developed so as to avoid closure approximation. Effective vector and axial vector coupling constants in the hadronic current are not used. The recoil matrix elements arise naturally from quark recoil in decaying neutrons. The formalism is applied to the neutrinoless double beta decay of ^{76}Ge to the ground state of ^{76}Se without and with inclusion of p-wave in addition to the dominant s-wave nuclear matrix elements in the decay amplitude. From the experimental lower bound for the decay half-life an upper limit for the effective Majorana mass of the neutrino is deduced and the right banded contribution to the charged week current estimated. (author). 18 refs., 1 appen dix., 6 tabs.

20202 (INIS-mf–13179, pp. 271-280) **Internal conversion studies on some M4, M3 and E3 transitions.** Radha Krishna, K. (Andhra Univ., Waltair (India). Dept. of Nuclear Physics). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

Conversion coefficients governing three M4 (^{87m}Sr, ^{69m}Zn and ^{199m}Hg), one M3 (sup(112m)In) and one E3 (sup(165m)Dy) transitions in five isotopes and K-conversion coefficient in four isotopes (sup(87m)Sr, sup(69m)Zn, sup(112m)In and sup(165m)Dy) have been measured using an X-ray peak to gamma and normalized peak to gamma methods. The total conversion coefficient (sup(199m)Hg) is measured using the intensity balance method. The experiments were carried out at BARC, Bombay and VECC, Calcutta. The results thus obtained are summarised. (author). 7 refs., 2 figs., 1 tab.

20203 (INIS-SU–308/A, pp. 43-48) **Experiments on finding γ-line intensity change in light effect on radioactive nuclides.** Davidonis, R. (AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki); Gechyauskajte, N.; Makaryunas, K.; Pyatrauskas, J.; Remejkis, V.; Rukhyale, B. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Light effect on the rate of radioactive transformation of ^{65}Zn nucleus is investigated. The investigations are conducted by γ spectrometry $\Delta I_\gamma/I_\gamma$ method where I_γ intensity change in a certain γ spectrum line resulting from a change of transition probability is measured. The basic transitions in the ^{65}Zn decay flowsheet are demonstrated. A difference of amplitude pulse distribution of illuminated and obscure ^{65}Zn+^{137}Cs sources is presented. The experiments show that the accuracy of $\Delta I_\gamma/I_\gamma$ determination in the experiment is no worse than 10^{-5} and that under sample illumination the probability of electron capture by ^{65}Zn nuclei is reduced. 10 refs.; 5 figs.; 1 tab.

20204 (INIS-SU–308/A, pp. 15-20) **Effect of conversion lines hyperfine shift in ^{181}Ta.** Lashko, A.P. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Feoktistov, A.I. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Transitions in ^{181}Ta are investigated. ^{181}Hf sources are produced in (n, γ) reaction under irradiation on a reactor target of ^{180}HfF$_4$ enriched up to 96.2%. Characteristics of transitions in ^{181}Ta and the calculated expected conversion K-, L_1- and L_2-line shifts are presented. The value and sign of relative shifts of conversion lines for K137-K133 and K137-K136 doublets agree qualitatively with theoretic calculations. It is not possible to measure L-line difference due to an insufficient source specific activity. 9 refs.; 1 fig.; 2 tabs.

20205 (UCRL-JC–104964) **Pattern recognition in gamma-gamma coincidence data sets.** Manatt, D.R. (Lawrence Livermore National Lab., CA (United States)); Barnes, F.L.; Becker, J.A.; Candy, J.V.; Henry, E.A.; Brinkman, M.J. Lawrence Livermore National Lab., CA (United States). Oct 1990. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-901057–31: 7. international symposium on capture gamma-ray spectroscopy and related topics, Pacific Grove, CA (United States), 14-19 Oct 1990). Order Number DE92011396. Source: OSTI; NTIS; GPO Dep.

Considerable amounts of tedious labor are required to manually scan high-resolution 1D slices of two dimensional γ-γ coincident matrices for relevant and exciting structures. This is particularly true when the interesting structures are of weak intensity. We are working on automated search methods for the detection of rotational band structures in the full 2D space using pattern recognition techniques. For nominal sized data sets (1024×1024), however, these techniques only become computationally feasible through the use of Fourier Transform methods. Furthermore the presentation of data matrices as images rather than series of 1D spectra has been shown to be useful. In this paper we will present the data manipulation techniques we have developed.

6633 Nuclear Reactions and Scattering, General

Refer also to citation(s) 20216

20206 (GSI–91-64(prepr.)) **Fluctuations in nuclear dynamics: Comparison of different methods.** Chapelle, F. (Lawrence Berkeley Lab., CA (United States). Nuclear Science Div.); Burgio, G.F.; Chomaz, P.; Randrup, J. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 51p. Contract DE-AC03-76SF00098. Order Number DE92516494. Source: OSTI; NTIS (US Sales Only); INIS.

We compare several methods for incorporating the effect of the fluctuating collision integral in Boltzmann-Uehling-Uhlenbeck simulations of nuclear dynamics: the method of correlated pseudo-particle collisions proposed by Bauer, Bertsch, and Das Gupta, the method of projection onto collective variables (specifically the local quadrupole moment of the momentum distribution) proposed by Ayik and Gregoire, and the method of direct simulation on a lattice in phase space recently proposed by Burgio, Chomaz, and Randrup. Considering a periodic two-dimensional nucleon gas in a constant one-body field, we examine the evolution of the fluctuations of the phase-space occupancy and their correlations. (orig.).

20207 (INIS-mf–13192, pp. 101-102) **Pre-equilibrium gamma emission.** Oblozinsky, P. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Achievements and problems of pre-equilibrium gamma emission in nuclear reactions are outlined. The field includes processes that, on the time scale, lie between direct reactions and compound-nucleus reactions. Several pre-equilibrium models exist to date. A common drawback is in the fact that the generally formulated models do not lend themselves to a straightforward transformation into computation schemes. Pre-equilibrium nuclear reaction theory includes a group of phenomenological models (the exciton and the hybrid models) and a group of quantum-mechanical models (which can be divided into multi-step compound models and multi-step direct models). Among problems that are being successfully addressed is the radiative mechanism in the pre-equilibrium state. Two pre-equilibrium mechanisms are now distinguished: the single-particle mechanism describing gamma spectra in the region of giant resonances (about 10 to 25 MeV), and the two-particle mechanism describing gamma spectra in the region of hard photons, which extends as far as the π meson threshold (about 140 MeV). (Z.S.). 16 refs.

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 19294, 20022, 20041, 20053, 20116, 20137, 20143, 20182, 20183, 20199, 20200

20208 (ANU-P–1082) **Fission time scales from prescission charged particle multiplicities.** Lestone, J.P.; Leigh, J.R.; Newton, J.O.; Hinde, D.J.; Wei, J.X.; Chen, J.X.; Elfstrom, S.; Popescu, D.G. Australian National Univ., Canberra (Australia). Research School of Physical Sciences. Jun 1991. 12p. Order Number DE92627398. Source: OSTI; NTIS (US Sales Only); INIS.

Accepted for publication in Physical Review Letters.

Pre-scission charged particle multiplicities, following fusion of ^{164,167,170}Er + ^{28}Si, have been measured. The multiplicities at the lowest bombarding energies limit the statistical model level density parameters. More importantly the α-data restrict the time spend near equilibrium and suggest evaporation occurs predominantly from larger deformations. 18 refs., 6 figs.

20209 (CONF-920140–1) **Asymmetrical fission and statistical emission of complex fragments from the highly excited ^{47}V compound nucleus.** Beck, C. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Djerroud, B.; Haas, F.; Freeman, R.M.; Hachem, A.; Heusch, B.; Morsad, A.; Vuillet-A-Crilles, M.; Youlal, M.; Abe, Y.; Dayras, R.; Wieleczko, J.P.; Legrain, R.; Pollaco, E.; Ray,.Oak Ridge National Lab., TN (United States). [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 30. winter meeting on nuclear physics; Bormio (Italy); 27 Jan - 1 feb 1992. Order Number DE92011064. Source: OSTI; NTIS; INIS; GPO Dep.

The properties of the fully damped (deep-inelastic and orbiting) and fusion (evaporation and fission) processes have been investigated in three entrance channels leading to the same ^{47} V compound nucleus at high excitation energies. No entrance channel effect has been observed in either the evaporation residue or the fission-like yields in contrast to the ^{28}Si + ^{12}C and ^{24}Mg + ^{16}O reactions in which the orbiting process still persists. The asymmetrical elemental distributions of the fully energy relaxed fragments are well described by fusion-fission models based respectively on the scission point and saddle point pictures. Finally a general discussion of the competition between orbiting and fusion-fission mechanisms in light heavy-ion reactions is presented in the framework of their calculated available number of open channels.

20210 (ESM–35) **Coupled-channels optical calculation of observables for electron-sodium scattering at 20 eV.** McCarthy, I.E. (Flinders Univ. of South Australia, Adelaide (Australia). Electronic Structure of Materials Centre); Nicholson, R.; Mitroy, J. Flinders Univ. of South Australia, Adelaide (Australia). Electronic Structure of Materials Centre. Aug 1991. 7p. Order Number DE92627368. Source: OSTI; NTIS (US Sales Only); INIS.

Electron-sodium scattering is calculated at 20eV by the coupled-channels optical method with 8 channels (3, 4, 5s; 3, 4, 5p; 3, 4d) explicitly coupled and the ionisation continuum represented by the half-on-shell optical potential. In comparison with experiment differential cross sections for 3s and 3p, 3p angular correlation data and asymmetry are well described. Some discrepancy remains with the 3s asymmetry. The calculation is compared with less-detailed calculations to identify the effects of different sets of channels. 11 refs., 1 tab.

20211 (GSI–91-68(prepr.)) **Charming aspects of heavy-ion collisions.** Vogt, R. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 5p. Order Number DE92516491. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss a model of open charm characteristics applied to RHIC energies. We also comment on the extrapolation of J/ψ production from hadron-nucleus to nucleus-nucleus interactions. (orig.).

20212 (GSI–92-02(prepr.)) **Convective stability of hot matter in ultrarelativistic heavy-ion collisions.** Florkowski, W. (Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany)); Friman, B.L.; Baym, G. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Jan 1992. 24p. Grant PHY-84-15064;PHY-89-21025. Order Number DE92516782. Source: OSTI; NTIS (US Sales Only); INIS.

The convective stability of strongly interacting matter undergoing hydrodynamic flow in ultrarelativistic heavy-ion collisions is studied in both the quark-gluon plasma and hadron gas phases. We find that this stability depends on the form of the initial conditions assumed for the hydrodynamic flow. In the case of initial conditions corresponding to partial transparency the flow of the quark-gluon plasma is stable whereas the flow of the hadron gas is convectively unstable. The timescale for hydrodynamic oscillations around the (stable or unstable) equilibrium state is found to be larger than the expected lifetime of the system, suggesting that the flow in either case is close to neutral convective equilibrium. (orig.).

20213 (GSI–92-06(prepr.)) **Effect of angular momentum dissipation on fluctuations of excitation functions in heavy-ion collisions.** Kun, S.Yu. (Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany)); Noerenberg, W. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Feb 1992. 21p. Order Number DE92517001. Source: OSTI; NTIS (US Sales Only); INIS.

We study the effect from dissipation of relative angular momentum on fluctuations of exitations functions in dissipative heavy-ion collisions. Dissipation and fluctuation of relative angular momentum modify and smooth the time-angle localization of the roating dinuclear system. The secondary maxima in the energy correlation function of the cross-section are shifted to smaller values of the energy difference, the shift depending on the relaxation time and the diffusion coefficient for the angular-momentum dissipation. The results are illustrated for the collision ^{28}Si(E_{lab}=130MeV)+^{48}Ti. (orig.).

20214 (GSI–92-07(prepr.)) **A midrapidity source of intermediate mass fragments in highly central collisions of Au+Au at 150 A MeV.** Alard, J.P. (Laboratoire de Physique Corpusculaire, 63 - Clermont-Ferrand (France)); Bastid, N.; Crouau, M.; Dupieux, P.; Fraysse, L.; Jorio, M.; Montarou, G.; Morel, P.; Basrak, Z.; Caplar, R.; Cindro, N.; Hoelbling, S.; Belayev, I.M.; Frolov, S.;

KorchagFOPI Collaboration at GSI. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Feb 1992. 11p. Order Number DE92517003. Source: OSTI; NTIS (US Sales Only); INIS.

Charged particles have been observed in collisions of Au on Au at incident energy of 150 A MeV using a high-granularity detector system covering approximatley the forward hemisphere in the center-of-mass system. Highly central collisions have been studied using a double selection criterion which combines large charged particle multiplicities with small transverse momentum directivities. In this class of events about one quarter of the total nuclear charge emerges as intermediate mass fragments with nuclear charges $Z>2$. These fragments are centred at midrapidity and are produced with large transverse velocities. (orig.).

20215 (GSI–92-08(prepr.)) **Formation of heavy quarks in ultrarelativistic heavy-ion collisions.** Schneider, S.M. (Frankfurt Univ. (Germany). Inst. fuer Theoretische Physik); Greiner, W.; Soff, G. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Feb 1992. 31p. Order Number DE92517000. Source: OSTI; NTIS (US Sales Only); INIS.

We investigate the production of heavy quarks in continuum and bound states in nuclear collisions. Creation for free banti b and tanti t quark pairs and for bottomonium and toponium in the ground state are computed at RHIC, LHC and SSC energies. Central and peripheral heavy-ion collisions are discussed. For top quark creation we assumed a mass range of 90 GeV $\leq m_t \leq$ 250 GeV. The creation rate for top quarks on peripheral collisions is estimated to be by a factor 40 to 130 smaller compared with corresponding central collisions. For m_t = 130 GeV we calculated a creation rate of about 4760 top quark pairs per day at the LHC (3.5 TeV/u) for Pb-Pb collisions. (orig.).

20216 (INIS-mf–13179, pp. 47-67) **Fission as a probe to understand heavy ion reaction mechanism and dynamics.** Saxena, Alok (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The study of nucleus-nucleus collisions provides a way to learn about the nuclear equilibration process in several collective degrees of freedom of much physical significance and their characteristics relaxation times. The reactions resulting from nucleus-nucleus collisions at intermediate energies can be broadly classified in four types: elastic (and quasi elastic) reaction, dinucleus reactions involving deep inelastic collisions, non-compound nucleus fusion reactions like fast-fission, quasi-fission and pre-equilibrium fission and true compound nucleus reactions. Experimentally, it is not always possible to identify uniquely the reaction products as belonging to the pre or post compound nucleus phase. This often leads to apparent anomaly in the interpretation of some of the experimental results in heavy ion reaction studies. Measurements of various observables in fission-like reactions provides information about the reaction mechanism and dynamics. Fission fragment angular distributions, which depend on the spin distributions and the shape parameters of the fissioning nucleus, give information about the fusion dynamics. Pre and post scission neutron multiplicities in fusion-fission reactions are used to determine pre-scission life times. Fragment-fragment angular correlation acts as a probe for linear momentum transfer characterising the reaction mechanism. The experimental results on the different aspects of the heavy ion fission studies and the information obtained on the dynamical features of the heavy ion collisions are summarised. (author). 36 refs., 12 figs.

20217 (INIS-mf–13179, pp. 281-298) **Delta production in nuclear reactions.** Santra, A.B. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

The most elementary of the charge exchange reactions are $p(^3He,t)\Delta^{++}$ and $p(p,\Delta^{++})n$. These are analyzed in detail. The $p(^3He,t)\Delta^{++}$ reaction is studied in distorted wave Born approximation considering both the direct and the exchange processes. Distorted wave functions are calculated using the eikonal approximation. A coupled channel formalism has been developed to analyze $p(p,\Delta^{++})n$ reaction. The distorted wave functions in this case also are written in eikonal approximation directly in terms of the scattering amplitudes. (author). 17 refs., 6 figs.

20218 (INIS-mf–13179, pp. 259-270) **Theory of cluster transfer resonances in heavy-ion reactions and the related phenomena.** Puri, R.K. (Panjab Univ., Chandigarh (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Physics. 1991. 310p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *Proceedings of the symposium on nuclear physics (held at Madras during December 1-4 1990): Invited talks/seminars. Vol. 33A (1990).* Order Number DE92001359. Source: OSTI; NTIS (US Sales Only); INIS.

A theoretical study of some recent experimental data on heavy-ion cluster-transfer resonances and the fusion cross-sections has been done. The energy density formalism (EDF), first derived by Vautherin and Brink (VB) (1972) in its satisfactory version, using Skyrme forces and the quantum mechanical fragmentation theory (QMFT) are used in calculations. Calculated results compare nicely with experimental data. (author). 19 refs., 11 figs., 2 tabs.

20219 (INIS-mf–13183, pp. 44) **A simple technique for the measurement of the spatial distribution of the energy spectrum of scattered photons for a ^{99M}Tc points source in water.** Serfontein, D.E. (Orange Free State Univ., Bloemfontein (South Africa). Dept. of Biophysics); Herbst, C.P.; Van Aswegen, A.; Loetter, M.G.; Pretorius, P.H. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ENERGY SPECTRA/measuring methods; ENERGY SPECTRA/photons; ALGORITHMS; COMPARATIVE EVALUATIONS; COMPTON EFFECT; PHOTONS; KEV RANGE 100-1000; MICROCOMPUTERS; MONTE CARLO METHOD; POINT SOURCES; SPATIAL DISTRIBUTION; TECHNETIUM 99; WATER

20220 (INIS-mf–13192, pp. 91-92) **Mesons in light nuclei.** Adam, J. Jr. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A succinct account is given of the state of the art in the field of the theory of meson exchange currents in electromagnetic and weak interactions with light nuclei in the region of intermediate energies. The basic starting points of the theory are outlined, as are some problems that have not yet been solved. (Z.S.). 15 refs.

20221 (INIS-mf–13192, pp. 97-100) **Nuclear physics with polarised heavy ions.** Karban, O. (Birmingham Univ. (United Kingdom)). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A brief summary is given of some recent experiments with polarized ^{6}Li, ^{7}Li and ^{23}Na sources, performed in Daresbury and Heidelberg. At the Daresbury tandem, the on-target beam intensities were about 10 pnA with polarization values about 80% and 50% of the maximum possible for lithium and sodium beams respectively. Discussed are the polarization effects in elastic scattering of aligned (tensor polarized) beams, the Tidal Symmetry model, the polarization effects in nucleon transfer reactions with heavy ions, and the fusion of polarized ^{7}Li and ^{23}Na. It can be concluded that the studies of nucleus-nucleus collisions with polarized projectiles provide important insight into details of the interaction and reveal new information on the reaction dynamics. Most of the data can be qualitatively explained using semi-classical models which are invaluable tools in understanding the basic physical processes taking place, without involving time-consuming quantum-mechanical calculations. (Z.S.). 10 refs.

20222 (INIS-mf–13192, pp. 247) **Influence of nucleon structure on high-energy elastic nucleon scattering.** Kundrat, V. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Lokajicek, M.; Krupa, D. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NUCLEAR STRUCTURE/elastic scattering; NUCLEONS/elastic scattering; NUCLEONS

20223 (INIS-mf–13192, pp. 248) **Angular distribution of primary γ-rays from $^{55}Mn(p,\gamma)^{56}Fe$ reaction.** Liptak, J. (Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta); Sterba, F.; Mai Xuang Trung. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MANGANESE 55 TARGET/proton reactions; ANGULAR DISTRIBUTION; GAMMA RADIATION; IRON 56

20224 (INIS-mf–13192, pp. 248) **Spectroscopic information from the reaction $^{14}C(^{3}He,\alpha)^{13}C$.** Kroha, V. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Burjan, V.; Cejpek, J.; Pokorny, J.; Svanda, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CARBON 14 TARGET/helium 3 reactions; ALPHA PARTICLES; CARBON 13; CROSS SECTIONS; SPECTROSCOPIC FACTORS

20225 (INIS-mf–13192, pp. 248) **Odd-even effect in yields from neutron induced fission of ^{235}U and prompt fission neutron spectra.** Volny, D. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Kristiak, J.; Gmuca, S.; Kliman, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FISSION/neutron emission; FISSION; FISSION SPECTRA; FISSION YIELD; MONTE CARLO METHOD; PROMPT NEUTRONS; URANIUM 235 TARGET

20226 (INIS-mf–13194, pp. 11-19) **Abnormally small yield of baryons and antibaryons as signal of quark-gluon plasma formation.** Braichevsky, S.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki); Goloviznin, V.V.; Snigirev, A.M.; Zinovjev, G.M. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

It is well known that the spectrum of protons and leptons is a meaningful signal of quark-gluon plasma formation because photons and leptons leave the plasma volume without interaction. Because of the confinement of quarks and gluons, with the hadron spectrum the situation is more complex. The present theory, unfortunately, does not allow to solve this problem using only the basic principle of the theory. This is why the hadron spectrum has to be calculated within the framework of some model. The use of the chromoelectric flux tube model is described. The radiation pressure was shown to be small and therefore the used approximation of a one-dimensional hydrodynamic expansion of plasma was legitimate. The tube formed between the quark and the plasma was supposed to be tightened in the shortest way (a minimum of energy) and with masses of u,d-quarks equal to zero. (Z.S.) 5 refs.

20227 (INIS-mf–13194, pp. 20-30) **Shock-wave phenomena in relativistic nuclear collisions.** Gorenstein, M.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A shock wave picture of the deconfinement transition was studied. Central heavy ion collisions were considered using the one-dimensional shock model. Such a picture of nuclear collisions with neglected transparency can probably be justified at intermediate energies $E_{lab}/A < 10$ GeV. For the description of the quark-gluon phase, the bag model equation of state was used with massless u and d quarks and gluons. A new generalized nuclear matter equation of state was formulated which preserves all advantages of the mean-field and phenomenological approaches. Non-trivial shock wave configurations have appeared in the one-dimensional hydrodynamic model of the compression stage in heavy ion collisions. These hydrodynamic configurations can serve as a signature of the deconfinement transition. (Z.S.) 2 figs., 13 refs.

20228 (INIS-mf–13194, pp. 128-137) **Global and local fluctuations in ultra-relativistic heavy-ion interactions.** Eklund, A. (Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics); Claesson, G.; Garpman, S.I.A.; Albrecht, R.; Bock, R.; Gutbrod, H.H.; Kolb, B.W.; Lund, I.; Siemiarczuk, T.; Awes, T.C.; Baktash, C.; Ferguson, R.; Lee, I.Y.; Obenshain, F.E.; Plasil,Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Charged multiplicity and transverse energy distribution from $^{16}O+Au$ at 200 A GeV are dealt with. These distributions were measured by the WA80 experiment at the CERN SPS. The widths of the distributions can be divided into different contributions each of which has a physical interpretation. By use of the Monte-Carlo code Fritiof developed for ultra-relativistic heavy-ion collisions, the sizes of the various contributions are calculated. The contributions are determined both for central and minimum bias collisions. The apparent importance of the region of observation and also the additional widening due to limited resolution and efficiency of the detectors are discussed. Comparisons are made with the widths measured by WA80. (author) 7 figs., 7 refs.

20229 (INIS-mf–13194, pp. 214-218) **Transverse momentum distribution of lepton pairs in hadron-nuclear collisions.** Buzaladze, M.E. (AN Gruzinskoj SSR, Tbilisi (USSR). Tbilisskij Matematicheskij Inst.); Garsevanishvili, V.R.; Hanna, K.M.; Matveev, V.A.; Menteshashvili, Z.R. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava

(Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Recent experimental data on the transverse momentum distributions of lepton pairs produced in pion-nucleus interactions revealed a strong nuclear dependence of these distributions. A comparison of the cross sections of lepton pair production in π^-W and π^-D interactions shows that the cross section ratio increases with increasing transverse momentum of the pairs. An attempt is described undertaken to explain the effect of increasing the lepton pair production cross section ratio with a rise in transverse momentum in the framework of the multiquark bag model, taking into account the transverse motion of quarks inside bags. (Z.S.) 1 fig., 8 refs.

20230 (INIS-mf–13194, pp. 203-213) **Hadron gas production in heavy ions collisions.** Ryskin, M.G. (AN SSSR, Leningrad (USSR). Inst. Yademoj Fiziki). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The role is discussed of final state interactions between secondary hadrons in heavy ion collisions. The $^{16}O+Au$ interaction was considered at an initial energy of 200 GeV/nucleon. Estimated were the secondary pions density, the mean number of rescattering ν_π, the size of the interaction volume, and the effective temperature of the hadron gas depending on the size of the pion gas cloud. The estimates are in agreement with the current experimental data. (Z.S.) 19 refs.

20231 (INIS-mf–13194, pp. 219-225) **Strong corrections to thermal dilepton production from a quark-gluon plasma.** Boehm, G. (Regensburg Univ. (Germany)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A perturbative calculation is outlined of the thermal dilepton production rate from a quark-gluon plasma of the order of $\alpha\alpha_s$. After an introduction motivating this computation, a new "old-fashioned" method is demonstrated of implementing perturbative QCD at non-zero temperature and density. (author) 2 figs., 7 refs.

20232 (INIS-mf–13194, pp. 226-234) **Dilepton emission from non-perturbative quark-gluon plasma.** Gorenstein, M.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki); Mogilevsky, O.A. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The analysis of thermodynamic data in lattice QCD using Monte Carlo calculations shows the presence of considerable non-perturbative effects also for $\epsilon\simeq\epsilon_0$ (ϵ is the energy density). These effects can be reproduced in a model with low momentum cut-off in the distribution functions of color quarks and gluons. In the quark-antiquark $\rightarrow 1^+1^-$ processes the cut-off, in effect, does not affect the thermal dilepton spectrum for large invariant mass ($M \simeq 2$ GeV). The low momentum cut-off changes dramatically the dilepton spectrum behavior for low invariant mass ($M < 2m_\pi$). The threshold effect on P_{transv} shows for low mass dilepton emission through quark-antiquark annihilation processes in non-perturbative QG plasma and it may lead to the peculiar structure of the dilepton spectrum within the transverse momentum region P_{transv} = (1-2) GeV. (Z.S.) 1 fig., 15 refs.

20233 (INIS-mf–13194, pp. 235-241) **Kinetic equations for the quark-gluon plasma and their semiclassical expansion.** Weigert, H. (Regensburg Univ. (Germany)). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

Extension of classical non-equilibrium, i.e. kinetic theories, into the domain of the gauge field theory requires the formulation of Wigner operators, physical space itself and kinetic equations determining non-equilibrium processes. A contribution is given to the reformulation of Wigner operators and their quantum kinetic equations with emphasis on the idea of physical phase space. (Z.S.) 2 figs., 11 refs.

20234 (INIS-mf–13194, pp. 296-302) **The concept of J/ψ formation time and the p_T-dependence of J/ψ suppression.** Lietava, R. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Nogova, A.; Horvath, I.; Pisut, J. Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

A short description is given of the method used for obtaining the quantum mechanical description of the time development of the quark-antiquark system immersed into the deconfining medium. The existence of such a medium (QGP or gas of quarks and gluons with large density) was the basic assumption for the method used. The question of the p_T-dependence of J/ψ suppression was also discussed. The results of the study can be summarized as follows: The quantum mechanical dissolution time $t_{1/2}\simeq0.2$ fm/c is smaller than the semiclassical estimate $\tau\simeq1$ fm/c; as a consequence, QGP dissolution cannot explain the observed p_T-dependence of J/ψ suppression; in the quantum mechanical approach to J/ψ dissolution a more detailed understanding is lacking of the formation of the quark-antiquark wave packet and of the sensitivity of J/ψ dissolution to the shape of the quark-antiquark wave function at $t=0$. (Z.S.) 2 figs., 10 refs.

20235 (INIS-mf–13194, pp. 355-360) **Transverse momentum dependent angular distributions with applications to hadron-nucleus collisions.** Blazek, M. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta; Jednota Slovenskych Matematikov a Fyzikov, Bratislava (Czechoslovakia). 1989. 395p. (CONF-8909475–: Hadron Structure '89, Smolenice (Czechoslovakia), 25-28 Sep 1989). In *Hadron structure '89: Proceedings of the conference.* Order Number DE92628522. Source: OSTI; NTIS (US Sales Only); INIS.

The approach involving coherent state expansions allows to obtain transverse-momentum-dependent angular distributions. Their explicit form as well as the low order approximation are given in the Collins-Soper and Gottfried-Jacson frames. The approximating expression obtained in the Collins-Soper frame is applied to the collision of a negative pion beam (194 GeV/c) with tungsten nuclei. Comparison of the results with experimental data shows sufficient agreement. (author) 8 refs.

20236 (INIS-SU–312, pp. 13-34) **Polarization phenomena in deuteron photodisintegration and dibaryon resonances.** Barannik, V.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Kulish, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj

Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

The problems of dibaryon resonances (DR) and computation of the amplitudes of DR photoexcitation in $\gamma d \rightarrow pn$ are discussed. Ambiquities of energy-independent multipole analyses of deuteron photodisintegration are considered. It is shown that polarization effect studies are necessary for determining the amplitudes of DR photoexcitation in $\gamma d \rightarrow pn$. Forecasts of observables corresponding to two polarized particles in deuteron photodisintegration are given. 77 refs.; 10 figs.; 5 tabs.

20237 (INIS-SU-312, pp. 88-93) **Review on the theoretical and experimental situation relative to the reactions $\gamma N \rightarrow \pi\Delta$ and $eN \rightarrow e\pi\Delta$.** Zayats, A.A. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

The calculation of observables in $\gamma N \rightarrow \pi\Delta$ reaction is performed in terms of the model which accounts for the contributions of single-pion gradient-invariant mechanism and a series of resonances. The theoretical and experimental situation associated with $\gamma N \rightarrow \pi\Delta$ and $eN \rightarrow e\pi\Delta$ reactions is reviewed. 24 refs.; 9 figs.

20238 (INIS-SU-312, pp. 69-84) **Electron scattering on deuterons.** Rekalo, M.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Gakh, G.I.; Rekalo, A.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

The analysis of polarization effects in the reaction of deuteron electrodisintegration is carried out within the scope of relativistic impulse approximation. A possibility of determining almost unknown charged form factor of neutron and establishing spin structure of deuteron wave function is investigated. 47 refs.; 13 figs.

20239 (INIS-SU-312, pp. 94-101) **Calculation of radiative corrections to the cross section of electron scattering on nuclei with the structure function method.** Merenkov, N.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of deep inelastic eA scattering taking into account radiative corrections is presented in the form of convolution of electron structure functions with hard part of cross section. The hard part of cross section is calculated in the lowest orders of perturbation theory. The derived formulas ensures accuracy exceeding 1% even in the cases when corrections of the first order for α are great (about 100%). 20 refs.; 3 figs.

20240 (INIS-SU-312, pp. 85-87) **Non-Abelian anomalies in vector meson decays and in photon-pion interactions.** Koval'chuk, V.A. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1989. 116p. (In Russian). In *Nuclear-physical researches (Theory and experiments): Scientific-technical collection.* Order Number DE92001360. Source: OSTI; NTIS (US Sales Only); INIS.

A possibility to study non-Abelian anomalies in radiation decays of vector mesons and in the reactions of photoproduction of three pions in Coulomb field of nuclei is discussed. 21 refs.; 1 tab.

20241 (ITF-90-7) **Diffraction processes with the participation of small-nucleon nuclei.** Tartakovskij, V.K.; Cherednichenko, V.A.; Evlanov, M.V.; Sokolov, A.M. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 33p. (In Russian). Order Number DE92627379. Source: OSTI; NTIS (US Sales Only); INIS.

The diffraction process $^3He(p,2p)^2H$ has been investigated on the offered approximative microscopic approach basis with the making use of calculated wave functions of final and initial states for NN-potentials which had been set. Protons and deuterons scattering cross-sections on light and heavy nuclei have been counted up taking into account the coulomb interaction. The role of an interference of the abovementioned interaction with a nuclear diffraction has been showed. Elastic scattering and diffraction disintegration cross-sections of ions ^6Li on nuclei and vector and tensor polarizations of the scattered ions ^6Li and deuterons which had been formed have been calculated in the dependence of a parameter of a diffusivity of an edge of the target nucleons. 18 refs.; 12 figs.

20242 (ITP-89-36) **Correlations between Nd scattering lengths for the mirror three-nucleon systems.** Kharchenko, V.F.; Navrotskij, M.A.; Shadchin, S.A. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 36p. Order Number DE92627380. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of the Faddeev-Noble integral equations for three nucleons, with the explicit separation and removal of the long-range polarization interaction between the proton and the deuteron, the direct calculation of the proton-deuteron scattering lengths in the model with the separable NN interaction is carried out. Also the quartet pd scattering length is calculated using the approximations for the NN t-matrices independent of the form of the interaction potential: the zero and the linear approximations in the triplet-spin effective range. Correlations between the Nd scattering lengths for the mirror 3N systems are studied. 35 refs.; 5 figs.; 3 tabs.

20243 (ITP-90-44) **Pion multiplicity in heavy-ion collisions: possible signature of the deconfinement transition.** Bugaev, K.A.; Gorenstejn, M.I.; Rischke, D.H. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 8p. Order Number DE92627389. Source: OSTI; NTIS (US Sales Only); INIS.

Due to the existence of a mixed phase of quark and hadronic matter a specific shock wave structure arises in central heavy-ion collisions. We show that this may result in a plateau-like behaviour of the excitation function of the pion multiplicity at freeze-out, which may serve as a new qualitative signature for the deconfinement transition. 12 refs.; 2 figs.

20244 (Juel-2540) **Pion- and photoabsorption on nuclei in the Δ-resonance region.** Koerfgen, B. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik. Oct 1991. 97p. (In German). Order Number DE92511504. Source: OSTI; NTIS (US Sales Only); INIS.

In charge-exchange reactions and in π-absorptin at intermediate energies the Δ peak position in nuclei is shifted downwards in energy compared to the Δ-excitation of the nucleon. For electromagnetic probes the experimental data do not show such a shift. We describe the excitation of the Δ in nuclei consistently for all these different probes using the isobar-hole-model (ΔN^{-1}-model). The shift of the Δ peak position in charge-exchange reactions and in π-absorption is due to an attractive ΔN^{-1}-residual interaction in the spin-longitudinal (o vectorxq vector) channel. A ΔN^{-1}-residual interaction consisting of the π-exchange potential alone is too attractive in the spin-longitudinal channel and shifts the Δ peak position for π-absorption to too low energies. In order to reproduce the Δ peak position we have to include short range correlations in the ΔN^{-1}-residual interaction. This is done either by adding a δ-force, parametrized through the Landau-Migdal-parameter $g'_{\Delta\Delta}$, to the π-exchange potential, or by multiplying the π-exchange potential with a correlation-function. This leads to a repulsive ΔN^{-1}-residual interaction in the spin-transverse (o vectorxq vector) channel, which shifts the Δ peak position in the calculations for photo-absorption to higher energies compared to the photo-absorption on the nucleon. (orig.).

20245 (KFK–4873) **User manual for the KfK code PCROSS.** Ravndal, S.; Oblozinsky, P.; Kelzenberg, S.; Cierjacks, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Aug 1991. 20p. Order Number DE92511423. Source: OSTI; NTIS (US Sales Only); INIS.

The PCROSS code calculates the so-called 'pseudo' cross sections for sequential (x,n) reactions and merges them together with 'collapsed' cross sections for neutron induced reactions into one file of cross sections. The file is tailored to provide an input for the FISPACT inventory code that calculates the activation and related radiological quantities of material irradiated in a neutron flux. The present report describes the structure of the KfK code PCROSS, outlines the role of subroutines, and provides necessary information for a practical user of the code. (orig.).

20246 (KFK–4960) **Coincidence cross sections within the quasi free break-up model for elastic projectile break-up.** Corcalciuc, V.; Jelitto, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Kernphysik. Nov 1991. 34p. Order Number DE92511424. Source: OSTI; NTIS (US Sales Only); INIS.

Scrutinizing the basic break-up model of Serber we show that it is possible to derive the triple differential cross sections for particle-particle coincidences in analytical form. An alternative interpretation within the opaque version of the model suggests to assign these cross sections to the elastic nonresonant projectile break-up due to the nuclear interaction. Distortion effects by the Coulomb field of the target are included in analogy to the Serber model. Beside the well known single maximum in the break-up spectra double and triple peak structures appear for certain combinations of the observation angles. The model yields reasonable agreement to the given experimental data, concerning the multiple peak structure as well as the order of magnitude for the absolute normalisation. Its application comprises the region of forward emission angles, especially the angular range of the classical Coulomb deflection. (orig.).

20247 (KIYal–90-12) **Ternary fission products energy properties determination within statistical model.** Lendel, A.I.; Marinets, T.I.; Sikora, D.I.; Charnovich, E.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 19p. (In Russian). Order Number DE92627399. Source: OSTI; NTIS (US Sales Only); INIS.

Within the frameworks of statistical model the most probable charges, common excitation energy of ternary fission fragments for ^{232}Th, ^{235,238}U, ^{237}Np, ^{239}Pu, ^{241}Am and ^{249}Cf are obtained. 6 refs.; 14 figs.

20248 (LA-UR–92-751) **Evidence for physics beyond the quasi-deuteron model in pion absorption.** Morris, C.L. (Los Alamos National Lab., NM (United States)); Zumbro, J.D.; Ransome, R.D.; Ritchie, B.G.; Watson, D.L.; Moore, C.F. Los Alamos National Lab., NM (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); North Atlantic Treaty Organization, Brussels (Belgium); Welch (Robert A.) Foundation, Houston, TX (United States). DOE Contract W-7405-ENG-36. Grant: CRG-890498. (CONF-9106194–8: International workshop on pions in nuclei, Penyscola (Spain), 2-9 Jun 1991). Order Number DE92011285. Source: OSTI; NTIS; INIS; GPO Dep.

Cross sections for pion absorption of T_π = 100 MeV on a range of nuclei leading to two or more energetic protons are presented. A large fraction of the total absorption cross section leads to events with large missing energies, presumably to neutrals. A comparison of the fraction of the total absorption cross section which appears to be the result of an undisturbed two-body mechanism with predictions of a simple semi-classical model of the attenuation of protons through final-state interactions leads to the conclusion that most of the absorption cross section on heavy nuclei is not due to a two-body absorption mechanism followed by final-state interactions but must be the result of pion absorption on three or more nucleons.

20249 (ZfK–751) **Experiment proposals for the 4π fragment spectrometer FOBOS. Reports of the FOBOS Collaboration workshop.** Sodan, H. (ed.). Zentralinstitut fuer Kernforschung, Rossendorf (Germany). Dec 1991. 90p. (In German). Contract BMFT 06DR100. (CONF-9104370–: Workshop of the FOBOS Collaboration, Dresden (Germany), Apr 1991). Order Number DE92516644. Source: OSTI; NTIS (US Sales Only); INIS.

These proceedings contain the articles presented at the named workshop. These are a description of the FOBOS 4π detector of charged particles at Dubna and experiment proposals for this detector concerning multifragmentation as critical phenomenon in hot nuclei, phase transformations in hot nuclei, fission of hot nuclei, research possibilities with radioactive nuclear beams at LNR-JINR, the fission of nuclei with $Z \geq 100$, induced by secondary-beam particles, studies of the fission of excited nuclei by the FOBOS detector, the fission of superdeformed states in the A=190 region, and the formation of light particles in heavy ion collisions and 4Π experiments. (HSI).

6635 Nuclear Mass Ranges

Refer also to citation(s) 19284, 19314, 20137, 20169, 20170, 20171, 20178, 20184, 20186, 20189, 20197, 20198, 20199, 20203, 20204, 20208, 20209, 20210, 20211, 20213, 20214, 20215, 20223, 20224, 20228, 20235, 20242, 20244, 20246, 20247, 20279

6636 Radiation Physics

Refer also to citation(s) 19984, 20562

20250 (DOE/ER/25086–2) **Fast Algorithms for transport models.** Manteuffel, T. Colorado Univ., Denver, CO (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER25086. Order Number DE92011432. Source: OSTI; NTIS; GPO Dep.

The first two years of this project were mainly focused on developing fast algorithms for the solution of the equations arising from models of single group isotropic transport of neutrally charged particles in slab geometry. In this context, the equation governing transport is an integral-differential equation involving one space variable and one angle variable. This paper discusses the solution of the equations.

20251 (INIS-mf–13183, pp. 43) **Shield design calculations for the NAC's proton therapy facility.** Van Rooyen, T.J. (National Accelerator Centre, Faure (South Africa)). South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SHIELDS/design; A CODES; BRAGG CURVE; DOSE RATES; IRON; MEV RANGE 100-1000; NAC CYCLOTRON; NEUTRON SPECTRA; NEUTRONS; PATIENTS; POLYETHYLENES; PROTON BEAMS; PROTONS; RADIATION TRANSPORT; SHIELDS; DESIGN; THERAPY

20252 (INIS-mf–13183, pp. 35) **The effect of environmental conditions on electron stopping powers in air.** Van der Merwe, D.G. (Johannesburg Hospital (South Africa). Dept. of Medical Physics); Keddy, R.J.; Ndlovu, N.P. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. ELECTRONS/stopping power; AIR; CORRECTIONS; DENSITY; ELECTRONS; ENVIRONMENT; HUMIDITY; KINETIC ENERGY; PRESSURE DEPENDENCE; S CODES; TEMPERATURE DEPENDENCE

20253 (INIS-mf–13183, pp. 35) **SCOLL: a fortran programme to calculate electron stopping powers.** Van der Merwe, D.G. (Johannesburg Hospital (South Africa). Dept. of Medical Physics); Keddy, R.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32.

annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Poster presentation. S CODES/electrons; S CODES/stopping power; COLLISIONS; COMPUTER CALCULATIONS; CORRECTIONS; DENSITY; FORTRAN; HUMIDITY; KINETIC ENERGY; MICROCOMPUTERS; PRESSURE DEPENDENCE; ELECTRONS; TEMPERATURE DEPENDENCE

20254 (INIS-mf–13183, pp. 43) **A computerized implementation of a non-linear equation to predict barrier shielding requirements.** Chamberlain, A.C. (Medical Univ. of Southern Africa, Pretoria (South Africa). Dept. of Medical Physics); Strydom, W.J. South African Association of Physicists in Medicine and Biology, Pretoria (South Africa). 1992. 46p. (CONF-9203132–: 32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology, Midrand (South Africa), 9-13 Mar 1992). In *SAAPMB summer school and congress.* Order Number DE92626268. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SHIELDING/equations; COMPUTERS; CONCRETES; ELECTRIC POTENTIAL; IMPLEMENTATION; LEAD; MATHEMATICAL MODELS; SHIELDING; EQUATIONS; WORK FUNCTIONS; X-RAY EQUIPMENT

20255 (INIS-mf–13192, pp. 254) **A contribution to the investigation of the partial coherence of X-rays.** Cernansky, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. X-RAY DIFFRACTION/coherent scattering.

20256 (INIS-mf–13192, pp. 254) **Finite-cluster multiple scattering theory of X-ray bremsstrahlung isochromatic spectra.** Sipr, O. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Simunek, A. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MULTIPLE SCATTERING/x-ray spectra; BREMSSTRAHLUNG; X RADIATION

20257 (KFK–4946) **FILLC - a subroutine to transfer nuclear group cross-sections from SIGMN blocks to data-arrays of neutron transport codes.** Kuefner, K.; Buckel, G.; Goetzmann, W.; Kiefhaber, E. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Dec 1991. 48p. (In German). Order Number DE92511581. Source: OSTI; NTIS (US Sales Only); INIS.

FILLC is a utility subroutine for use in the KAPROS versions of multigrop S_N codes. Within KAPROS a couple of modules create and modify nuclear cross sections and store them in a so-called SIGMN file. FILLC stores group cross sections in an array C used by some S_N codes with data provided in a SIGMN file. This report documents this interface with release number 3.4. (orig.).

20258 (KFK–4956) **Reference manual for the KfK code PCROSS.** Ravndal, S.; Oblozinsky, P.; Kelzenberg, S.; Cierjacks, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Dec 1991. 27p. Order Number DE92511582. Source: OSTI; NTIS (US Sales Only); INIS.

The PCROSS code calculates the so-called 'pseudo' cross sections for sequential (x,n) reactions and merges them together with 'effective' cross section for neutron induced reactions into one file of 'collapsed' cross sections. The file is tailored to provide an input for the FISPACT inventory code that calculates the activation and related radiological quantities of material irradiated in given neutron fields. The report summarizes calculational procedure and provides the reader with essential technical details of the code PCROSS (version 1.0) such as description of parameters, common blocks and subroutines. (orig.).

20259 (LA–12258) **Analytic score comparison of geometry splitting and exponential transform for a simple Monte Carlo problem.** Booth, T.E. Los Alamos National Lab., NM (United States). Mar 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92013108. Source: OSTI; NTIS; GPO Dep.

The interpretation of the statistical error estimates produced by Monte Carlo transport codes is still somewhat of an art. Empirically, there are variance reduction techniques whose error estimates are almost always reliable and there are variance reduction techniques whose error estimates are often unreliable. Unreliable error estimates usually result from inadequate large score sampling from the score distribution's tail. This paper provides the analytic score distribution for geometry splitting/Russian roulette applied to a simple Monte Carlo problem and the analytic score distribution for the exponential transform applied to the same Monte Carlo problem. It is shown that the large score tails of the two distributions behave very differently. In particular, the exponential transform is shown to have an infinite variance for some parameter choices.

20260 (SAND–91-1634) **ITS Version 3.0: The Integrated TIGER series of coupled electron/photon Monte Carlo transport codes.** Halbleib, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Kensek, R.P.; Mehlhorn, T.A.; Valdez, G.D.; Seltzer, S.M.; Berger, M.J. Sandia National Labs., Albuquerque, NM (United States). Mar 1992. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92011518. Source: OSTI; NTIS; GPO Dep.

ITS is a powerful and user-friendly software package permitting state-of-the-art Monte Carlo solution of linear time-independent coupled electron/photon radiation transport problems, with or without the presence of macroscopic electric and magnetic fields of arbitrary spatial dependence. Our goal has been to simultaneously maximize operational simplicity and physical accuracy. Through a machine-portable utility that emulates the basic features of the CDC UPDATE processor, the user selects on of eight codes for running on a machine of one of at least four major vendors. The ease with which this utility is applied combines with an input scheme based on order-independent descriptive keywords that makes maximum use of defaults and internal error checking to provide experimentalists and theorists alike with a method for the routine but rigorous solution of sophisticated radiation transport problems. Physical rigor is maximized by employing the best available cross sections and sampling distributions, and the most complete physical model for describing the production and transport of the electron/photon cascade from 1.0 GeV down to 1.0 keV. Feasibility of construction permits the more sophisticated user to tailor the codes to specific applications and to extend the capabilities of the codes to more complex applications through simple update procedures. Version 3.0, the latest version of ITS, contains major improvements to the physical model, additional variance reduction via both internal restructuring and new user options, and expanded input/output capabilities.

20261 (SAND–92-0065C) **Cautions in using x-ray measurements derived from broad spectral response functions to determine the peak voltage of flash bremsstrahlung sources.** Fehl, D.L.; Baldwin, G.T.; Lorence, L.J. Jr. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–11: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011154. Source: OSTI; NTIS; GPO Dep.

Because a direct measurement of the voltage (V) is pulsed power bremsstrahlung sources can be difficult, the energy spectrum of X- rays emitted is sometimes used to infer V. Both the voltage and current in such sources vary with time. Moreover, for modern x-ray simulators with multiple cathodes, multiple voltages may exist simultaneously. We demonstrate here how such sources lead to systematic errors in several types of simple-to-field x-ray voltage measurements, especially those with broad spectral response functions, when calibrated against constant-potential bremsstrahlung spectra. 11 refs.

20262 (UCRL-CR–109223) **Advanced computational transport methods for curvilinear geometries: Final report.** Martin, W.R. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering); Larsen, E.W.; Palmer, T.S.; Adams, M.L. Lawrence Livermore National Lab., CA (United States); Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. 30 Oct 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011290. Source: OSTI; NTIS; GPO Dep.

During the last year, a considerable effort was mounted to devise accurate and efficient numerical methods for the solution of curvilinear transport problems in the optically thick, diffusive regime. Much work has already been completed on these methods in slab and x-y geometries. The principle tool in designing these methods is an asymptotic analysis that permits one to theoretically assess the accuracy of a transport numerical method for diffusive regions in which the spatial grid is optically thick. A transport numerical method is said to be accurate for thick, diffusive problems if an asymptotic analysis yields an accurate discretized diffusion equation and accurate boundary conditions. If a given transport discretization has this property, then it is possible to incorporate this "asymptotic" diffusion equation into a diffusion synthetic acceleration (DSA) algorithm that will yield a very rapidly convergent iterative solution. The search for efficiently solvable DSA algorithms in one and two spatial dimensions has been going on for the past 20 years. Although many techniques are available now in one-dimensional geometries, in other geometries only the diamond differenced S_N equations have been efficiently solved using conventional DSA. This is because this particular transport differencing yields a sufficiently simple low-order diffusion equation that lends itself to solution by multigrid methods. Conventional DSA when applied to most other transport discretizations leads to more complicated discrete diffusion equations that are not as efficiently solvable. The asymptotic analysis procedure outline here is an attempt to overcome this obstacle.

6640 Atomic and Molecular Physics

Refer also to citation(s) 20168

20263 (DOE/DP/40200–196) **1991 Summer research program for high school juniors at the University of Rochester's Laboratory for Laser Energetics: Student research reports.** Rochester Univ., NY (United States). Lab. for Laser Energetics. Sep 1991. 140p. Sponsored by National Science Foundation, Washington, DC (United States); USDOE, Washington, DC (United States). DOE Contract FC03-85DP40200. Contract RCD-9055084. (UR-228). Order Number DE92011316. Source: OSTI; NTIS; GPO Dep.

Ten students participated in the 1991 summer high school student research program at the University of Rochester's Laboratory for Laser Energetics (LLE). The participants spent 8 weeks working and learning at LLE. They spent most of their time working on individual research projects. Each student was assigned a project, upon which he/she worked under the direct supervision of one of the staff members of the laboratory. The students, their high schools, and their projects are listed in Table 1. The program culminated in oral and written reports describing their work. The oral reports were presented at a symposium on 23 August 1991, at which the student's parents and teachers and members of the LLE staff were present. The written reports are collected in this volume. The titles of the works are UV alignment table; neutron yields can be measured by using the relative gain of a photomultiplier tube; scattering in isotropic and anisotropic media; a better approximation of the diffusion equation; use of the SLAC code to produce a photoemissive electrostatic electron gun; spatial resolution deteriorates with increasing film exposure; analysis of refractive image distortion; making of pinholes for x-ray pinhole cameras; does perturbation theory accurately describe multiphoton ionization? and wave front analysis using shearing interferometry.

20264 (DOE/ER/25099–1) **Numerical methods for molecular dynamics: Progress report.** Skeel, R.D. Illinois Univ., Urbana, IL (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER25099. Order Number DE92010934. Source: OSTI; NTIS; GPO Dep.

This report summarizes our research progress to date on the use of multigrid methods for three-dimensional elliptic partial differential equations, with particular emphasis on application to the Poisson-Boltzmann equation of molecular biophysics. This research is motivated by the need for fast and accurate numerical solution techniques for three-dimensional problems arising in physics and engineering. In many applications these problems must be solved repeatedly, and the extremely large number of discrete unknowns required to accurately approximate solutions to partial differential equations in three-dimensional regions necessitates the use of efficient solution methods. This situation makes clear the importance of developing methods which are of optimal order (or nearly so), meaning that the number of operations required to solve the discrete problem is on the order of the number of discrete unknowns. Multigrid methods are generally regarded as being in this class of methods, and are in fact provably optimal order for an increasingly large class of problems. The fundamental goal of this research is to develop a fast and accurate numerical technique, based on multi-level principles, for the solutions of the Poisson-Boltzmann equation of molecular biophysics and similar equations occurring in other applications. An outline of the report is as follows. We first present some background material, followed by a survey of the literature on the use of multigrid methods for solving problems similar to the Poisson-Boltzmann equation. A short description of the software we have developed so far is then given, and numerical results are discussed. Finally, our research plans for the coming year are presented.

6641 Theory of Electronic Structure of Atoms and Molecules

Refer also to citation(s) 20323

20265 (GSI–92-03(prepr.)) **Relativistic effects in physics and chemistry of element 105. Pt. 2. Electronic structure and properties of group 5 elements bromides.** Pershina, V. (Kassel Univ. (Germany). Theoretical Physics Dept.); Sepp, W.D.; Fricke, B.; Kolb, D.; Ionova, G.V.; Schaedel, M. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Jan 1992. 31p. Order Number DE92516789. Source: OSTI; NTIS (US Sales Only); INIS.

Relativistic SCC-DS-DVM calculations have been done for the series of molecules MBr_5, where M = Nb, Ta, Pa, and element 105, Ha. The electronic structure data show that the trends within the group 5 pentabromides resemble those for the corresponding pentaclorides with the latter being more ionic. Estimation of the volatility of group 5 bromides has been done on the basis of the molecular orbital calculations. According to the results of the theoretical interpretation $HaBr_5$ should be more volatile than $NbBr_5$ and $TaBr_5$. (orig.).

20266 (INIS-mf–13178, pp. 10-19) **Small metal particles and the ideal Fermi gas.** Barma, Mustanpir (Tata Inst. of Fundamental Research, Bombay (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-8912137–: Solid state physics symposium, Madras (India), 19-22 Dec 1989). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

Kubo's theoretical model of a small metal particle consists of a number of noninteraction electrons (an ideal Fermi gas) confined to a finite volume. By 'small' it meant that the size of the particle is intermediate between that of a few atoms cluster and the bulk solid, the radius of the particle being 5 to 50 Angstroms. The model is discussed and size dependence of various energy scales is studied. For a fermi gas confined in a sphere or a cube, two size-dependent energy scales are important. The inner scale δ is the mean spacing between successive energy levels. It governs the very low temperature behaviour. The outer scale Δ is associated with the shell structure when $\delta \leq T < \Delta$, thermodynamic properties show an oscillatory fluctuations around a smooth background as the size or energy is varied. (M.G.B.) 23 refs.

20267 (INIS-mf–13178, pp. 26-49) **Electronic structure of interfaces.** Das, G.P. (Bhabha Atomic Research Centre, Bombay (India). Solid State Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-8912137–: Solid state physics symposium, Madras (India), 19-22 Dec 1989). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

A unified theoretical approach based on linear muffin-tin orbital method is presented to study epitaxial solid-solid interfaces. Metal ceramic interfaces, insulator semiconductor interface and metal semiconductor interface are discussed. (M.G.B.). 80 refs ., 12 figs.

20268 (INIS-SU–308/A, pp. 9-14) **Precise measurements of KLL group of Auger electrons in the range of 63 $\leq Z \leq$ 74.** Bulgakov, V.V. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kaznovetskij, A.B.; Kirishchuk, V.I.; Stril'chuk, N.V.; Feoktistov, A.I. AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

Measurements of Eu Auger electron KLL spectra in ^{153}Sm and ^{153}Gd decay, Tm ones - in ^{169}Yb decay, Lu - in ^{175}Hf decay and W Auger electrons in the decay of ^{182,183}Ta and ^{183,184,184m}Re isotope mixture are conducted. When comparing the obtained Auger spectrum KLL group line intensities to the calculated ones a satisfactory agreement between them is observed on the whole. However, there still are no correct descriptions of KL_1L_2 doublet component intensities, and the total intensity of $KL_1L_3(^3P_1)$- and $KL_1L_3(^3P_2)$-lines in ^{153}Sm decay appears to be much lower than in ^{153}Gd decay. 11 refs.; 1 fig.

20269 (INIS-SU–308/A, pp. 49-54) **Hyperfine shifts of roentgen levels, excited in electron capture.** Fedorov, V.V. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki). AN Litovskoj SSR, Vilnius (USSR). Inst. Fiziki; AN SSSR, Moscow (USSR). Nauchnyj Sovet po Yadernoj Spektroskopii. 1990. 168p. (In Russian). (CONF-9006411–: 8. seminar on precise measurements in nuclear spectroscopy, Uzhgorod (USSR), 12-13 Jun 1990). In *Precision problems in nuclear spectroscopy: 1990.* Order Number DE92001356. Source: OSTI; NTIS (US Sales Only); INIS.

A general theory of hyperfine shifts of X radiation K, L_{I-III}, ...-levels induced under arbitrary electron captures is constructed. A shift of gravity center of an X radiation level induced under electron capture is determined. An expression for population of hyperfine structure components excited under electron capture is derived. 8 refs.

20270 (UCRL-JC–109000) **Korringa-Kohn-Rostoker electronic structure method for space-filling cell potentials.** Gonis, A. (Lawrence Livermore National Lab., CA (United States)); Butler, W.H.; Zhang, X.-G. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;W-7405-ENG-48. (CONF-911202–39: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92006596. Source: OSTI; NTIS; GPO Dep.

The multiple scattering theory (MST) method of Korringa, and of Kohn and Rostoker for determining the electronic structure of solids, originally developed in connection with potentials bounded by non-overlapping spheres (muffin-tin (MT) potentials), is generalized to the case of space-filling potential cells of arbitrary shape through the use of a variational formalism. This generalized version of MST retains the separability of structure and potential characteristic of the application of MST to MT potentials. However, in contrast to the MT case, different forms of MST exhibit different convergence rates for the energy and the wave function. Numerical results are presented which illustrate the differing convergence rates of the variational and nonvariational forms of MST for space-filling potentials.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 19062, 19065, 19147, 20333

20271 (BARC–1991/P/003) **Spectroscopy Division: progress report for 1990.** Sharma, A. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.); Marathe, S.M. (eds.). Bhabha Atomic Research Centre, Bombay (India). 1991. 196p. Order Number DE92627427. Source: OSTI; NTIS (US Sales Only); INIS.

This report summarises the work done by members of the Spectroscopy Division both within BARC as well as in scientific institutions elsewhere during the calendar year 1990. Main areas of research activity include atomic spectroscopy for hyperfine structure and isotope shift determination, theoretical and experimental studies of diatomic molecules, infrared and Raman spectroscopy of polyatomic molecules, design and fabrication of beam line optics for INDUS-I synchrotron radiation source, beam foil spectroscopy and laser spectroscopy of various atomic and molecular systems. Major experimental facilities that have been utilised include a fourier transform spectrometer, an excimer laser pumped dye-laser and a continous wave argon-ion laser. The report also includes the spectroscopic analytical service rendered for various DAE units and describes briefly some new analytical facilities like laser enhanced ionization in flames and resonance ionization mass spectroscopy using pulsed lasers which are being set up. The above activites were reported by members of the Spectroscopy Division via invited lectures, papers presented in various national and international conferences and publication in scientific journals. Details of these are given at the end of the report. (author). figs., tabs.

20272 (DOE/ER/13965–4) **Spectroscopic probes of vibrationally excited molecules at chemically significant energies: Progress report, August 15, 1991–August 14, 1992.** Rizzo, T.R. Rochester Univ., NY (United States). Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13965. Order Number DE92011026. Source: OSTI; NTIS; INIS; GPO Dep.

These experiments apply multiple-laser spectroscopic techniques to investigate the bond energies, potential surface topologies, and dissociation dynamics of highly vibrationally excited molecules. Infrared-optical double resonance pumping of light atom stretch vibrations in H_2O_2 and HN_3 prepares reactant molecules in single rovibrational states above the unimolecular dissociation threshold on the ground potential surface, and laser induced fluorescence detection of the OH or NH fragments monitors the partitioning of energy into individual product quantum states. Product energy partitioning data from H_2O_2 dissociation provide a stringent test of statistical theories as well as potential energy surface calculations. Ongoing work on HN_3 seeks to determine the height of the barrier to dissociation on the singlet potential energy surface. Our most recently developed spectroscopic scheme allows the measurement of high vibrational overtone spectra of jet-cooled molecules. This approach uses CO_2 laser infrared multiphoton dissociation followed by laser induced fluorescence product detection to measure weak vibrational overtone transitions in low pressure environments. Application of this scheme to record the $\Delta V_{OH}=4$ and $\Delta V_{OH}=5$ transitions of CH_3OH cooled in a supersonic free-jet demonstrates both its feasibility and its utility for simplifying high vibrational overtone spectra.

20273 (DOE/ER/14066–T2) **[High-resolution Raman spectroscopy of complexes and clusters in molecular beams]: Progress report, [FY 1989].** California Univ., Los Angeles, CA (United States). [1989]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER14066. Order Number DE92013523. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. COMPLEXES/raman spectroscopy; MOLECULAR BEAMS/raman spectroscopy; PROGRESS REPORT; COMPLEXES; NEODYMIUM LASERS; BENZENE; RAMAN SPECTRA; CLUSTER BEAMS

20274 (INIS-mf–13192, pp. 143-144) **Jahn-Teller effect in emission spectra of heavy metal impurity centres.** Polak, K. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia).

Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Ionic crystals doped with ns^2 ions belong to candidates for tunable solid state laser materials. For the absorption and emission of ns^2 ions, the most important interactions are spin-orbital interactions, singlet-triplet mixing and the Jahn-Teller effect. For the group of potassium halide crystals doped with a low concentration of Pb^{2+} ions, the results are presented of measurements of actual decay. Time resolved luminescence spectroscopy was used. The experiments carried out indicate that the phenomenon of alkali-halide ns^2 phosphor emission is more complicated than would follow from results published up to now. (Z.S.). 1 fig., 1 tab., 6 refs.

20275 (LRAP–119) **Progress report 1989-90.** Lund Univ. (Sweden). Dept. of Physics. [1991]. 118p. Order Number DE92624995. Source: OSTI; NTIS (US Sales Only); INIS.

Research on emission spectroscopy and term analysis is being pursued with emphasis on the analysis of the spectra of multiply ionized inert gases. In the basic atomic laser spectroscopy group the experimental activities employing CW high-resolution techniques and time-resolved methods are well integrated with a theoretical atomic physics programme. A precision method for lifetime measurements using a mode-locked dye laser in conjunction with photon counting techniques has been further refined. Pulsed level-crossing, optical-double-resonance and quantum-beat spectroscopy have been used extensively to attain new accurate data. Studies of terawatt laser generation techniques have been made in preparation for the establishment of such techniques at the Lund Laser Center. For several years, a major project concerned with combustion diagnostics using lasers has been pursued in Lund. Many aspects of flame kinetics, NO_x and soot formation, turbulence and spark ignition are being studied using laser-induced fluorescence. Raman and CARS spectroscopy. Theoretical work on kinetics and spark ignition supplements the extensive programme. Methods for combustion diagnostics based on multicolour imaging, degenerate four-wave mixing and diode-laser frequencymodulation spectroscopy are being developed. Environmental remote sensing using optical techniques is another applied spectroscopy project. Our mobile lidar system has been extensively used for range-resolved mapping of atomic mercury. During the last two years our activities in the medical field have increased. A research programme on cancer tumour detection and treatment using lasers is being pursued jointly with the Lund University Hospital. Work on spectroscopic diagnostics of atherosclerotic plaque is also being actively pursued, aiming at spectroscopic guidance in fibreoptic plaque ablation using excimer laser radiation. Measurements have been performed during open-heart surgery.

20276 (UCRL-JC–104651) **Spectroscopic diagnostics of ionization balance and electron density in 20 picosecond laser-produced aluminum and magnesium plasmas.** Osterheld, A.L.; Shepherd, R.L.; Eder, D.; Walling, R.S.; Keane, C.; Matthews, D.; Young, B.K.F.; Goldstein, W.H.; Stewart, R.E.; Charatis, G. Lawrence Livermore National Lab., CA (United States). Jan 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9009266–15: 2. international colloquium on X-ray lasers, York (United Kingdom), 17-21 Sep 1990). Order Number DE92009114. Source: OSTI; NTIS; INIS; GPO Dep.

A quasi-steady state, collisional-radiative model is used to analyze spectra from aluminum and magnesium plasmas produced by irradiation with 20 picosecond pulses of 0.53μ laser light. The model infers the ionization balance and electron density of a plasma from the relative intensities of H-like and He-like x-ray transitions.

6643 Collision Phenomena

Refer also to citation(s) 19270, 20285

20277 (CONF-910746–5) **Evidence for interference between resonant and nonresonant transfer and excitation.** Benhenni, M. (North Carolina Univ., Chapel Hill, NC (United States). Dept. of Physics and Astronomy); Shafroth, S.M.; Swenson, J.K.; Schulz, M.; Giese, J.P.; Schone, H.; Vane, C.R.; Dittner, P.F.; Datz, S. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-87ER40361. From 17. international conference on the physics of electronic and atomic collisions; Brisbane (Australia); 10-16 Jul 1991. Order Number DE92011779. Source: OSTI; NTIS; INIS; GPO Dep.

The first angular distribution measurements of Auger electrons arising from transfer and excitation Auger (TE) processes were performed at O^{5+} projective energies of 8 MeV, where the resonant (RTE) and the nonresonant (NTE) transfer and excitation have equal contributions in populating the $(1s2s2p^2)^3D$ state, and at 13 MeV where RTE is predominant and at 6 MeV where NTE is more significant. The TE angular distributions are strongly forward peaked along the beam direction. The data were fitted to $w(\theta_p)=C[1+a_2P_2(\cos\theta_p)+a_4P_4(\cos\theta p)]$ and the magnetic substate population probabilities were inferred.

20278 (DOE/ER/13262–8) **Excitation of atoms and molecules in collisions with highly charged ions: Progress report, January 1, 1991–March 1, 1992.** Watson, R.L. Texas A and M Univ., College Station, TX (United States). Cyclotron Inst. 1 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER13262. Order Number DE92012658. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses research of multicharged nitrogen, oxygen and carbon monoxide molecular ions produced with collision with multicharged argon ions. Properties like ionization, dissociation, and excitation are investigated. (LSP)

20279 (ESM–33) **New applications of (e,2e) techniques.** Weigold, E. Flinders Univ. of South Australia, Adelaide (Australia). Electronic Structure of Materials Centre. Jul 1991. 12p. (CONF-910746–: 17. international conference on the physics of electronic and atomic collisions, Brisbane (Australia), 10-16 Jul 1991). Order Number DE92627428. Source: OSTI; NTIS (US Sales Only); INIS.

The flexibility of the (e,2e) technique in obtaining information on both structure and collision dynamics is demonstrated. Examples of structure information are electron momentum spectroscopy studies of laser excited Na atoms and amorphous carbon films. The role of post-collision effects and correlations is explored by measurements in the autoionising region of helium and in innershell ionisation of argon. 26 refs., 11 figs.

20280 (GSI–91-67(prepr.)) **Radiative electron capture into the K-, L-, and M-shell of decelerated, hydrogenic Ge projectiles.** Stoehlker, T. (Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany)); Kozhuharov, C.; Livingston, A.E.; Mokler, P.H.; Stachura, Z.; Warczak, A. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Dec 1991. 13p. Grant KBN 201779101. Order Number DE92516498. Source: OSTI; NTIS (US Sales Only); INIS.

Radiative Electron Capture (REC) in 4 to 12 MeV/u $Ge^{31+}\rightarrow H_2$ collisions has been studied using an X-ray/particle coincidence technique. This technique allowed a systematic investigation of K-shell REC as well as a separation of REC into the projectile L- and M-shells. The cross sections are discussed within a general scaling picture based on the reduced projectile velocity. (orig.).

20281 (INIS-mf–13192, pp. 117-120) **Calculation of the radiative transition matrix elements between continuous electronic states.** Vackar, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Calculation of the matrix elements between wave functions of electronic states which fall into the continuous region of the energy spectrum is a prerequisite when solving certain problems associated with electron scattering in solids. A fast numeric method is reported on; it has been developed for the calculation of radiative matrix elements in problems involving a spherical symmetric potential inside a finite region. Outside that region, analytical integration is performed. Particular attention is paid to the numerical stability with regard to the high energy of the incident electrons (higher than 5 keV) which are described by rapidly oscillating functions. The method enables calculation of higher order terms in the multipole series. The problem in question arose during investigation of the scattering process in bremsstrahlung isochromatic spectroscopy. The fast incident electron is slowed down by the Coulomb field of the scattering atom, and a photon is emitted; the latter is measured with an isochromatic detector. (Z.S.). 11 refs.

20282 (NEI-NO-192) **Studies of collision dynamics in electron capture processes.** Hansen, J.P. Oslo Univ. (Norway). Fysisk Inst. Dec 1989 131p. Order Number DE92628654. Source: OSTI; NTIS (US Sales Only); INIS.

Reprints of ten previously printed papers are attached.

The thesis presents some recent development in time-dependent coupled channel methods for one- and two-electron systems. The methods have been applied to detailed studies on several different aspects of charge transfer processes in ion-atom collisions at intermediate to low energies. Measurable quantities, such as partial and total cross sections, partial cross sections in projectile energy gain, orientation and alignment fractions, have been calculated. Confrontation with experiments has in general given good agreement. 14 refs., 2 figs.

20283 (UCRL-JC-110189) **The nonequilibrium molecular dynamics.** Hoover, W.G. Lawrence Livermore National Lab., CA (United States). Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920318-1: International workshop on dynamical fluctuations and correlations in nuclear collisions, Aussois (France), 12-16 Mar 1992). Order Number DE92011760. Source: OSTI; NTIS; INIS; GPO Dep.

MOLECULAR DYNAMICS has been generalized in order to simulate a variety of NONEQUILIBRIUM systems. This generalization has been achieved by adopting microscopic mechanical definitions of macroscopic thermodynamic and hydrodynamic variables, such as temperature and stress. Some of the problems already treated include rapid plastic deformation, intense heat conduction, strong shockwaves simulation, and far-from-equilibrium phase transformations. Continuing advances in technique and in the modeling of interatomic forces, coupled with qualitative improvements in computer hardware, are enabling such simulations to approximate real-world microscale and nanoscale experiments.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 19334, 20265, 20277, 20485

20284 (DOE/ER/13590-10) **Studies of atmospheric molecules by multiphoton spectroscopy: Progress report, July 15, 1989–October, 1991.** Johnson, P.M. State Univ. of New York, Stony Brook, NY (United States). Dept. of Chemistry. Oct 1991. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13590. Order Number DE92012668. Source: OSTI; NTIS; GPO Dep.

Carbon dioxide presents a great challenge to spectroscopy because of its propensity toward dissociation in all of its excited states. Multiphoton ionization spectroscopy is usually not applicable to the study of dissociating molecules because the dissociation competes effectively with ionization, resulting in no signal. We reasoned, however, that with high enough laser fluence, ionization could compete with dissociation in the longer lived states, exposing them for study from the continuous spectral background resulting from rapidly dissociating states. We describe the various spectroscopic and photophysical effects found through the multiphoton ionization and multiphoton photoelectron spectra. A recently developed variant of threshold ionization spectroscopy, usually called ZEKE, has shown a great deal of usefulness in providing the same information as traditional photoelectron spectroscopy but with higher resolution and much better signal-to-noise when using standard laboratory lasers. Threshold ionization techniques locate the states of an ion by scanning a light source across the ionization continuum of a neutral and somehow detecting when electrons are produced with no kinetic energy. We chose to develop our capabilities in threshold ionization spectroscopy using aromatic molecules because of their importance and because their electronic structure allows a pump-probe type of excitation scheme which avoids the use of vacuum ultraviolet laser beams. Among aromatics, the azines are noted for their small S_1-T_1 energy gap which give them unique and interesting photophysical properties. We have continued our work on the multiphoton spectrum of metastable nitrogen produced by an electric discharge in supersonic beam. We have been able to assign more of the lines and simulated their rotational structure but many peaks remain unassigned.

20285 (DOE/ER/13634-2) **Measurements of ionization balance parameters in atomic ions: Final report, May 1, 1982–May 31, 1989.** Kohl, J.L. Smithsonian Astrophysical Observatory, Cambridge, MA (United States). Jun 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13634. Order Number DE92010658. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the measurement of the dielectronic recombination rate of carbon 3 plus ions. (LSP).

20286 (DOE/ER/13700-T2) **Determination of stepsize parameters for intermolecular vibrational energy transfer: Final report, May 1, 1987–December 31, 1991.** Tardy, D.C. Iowa Univ., Iowa City, IA (United States). Mar 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13700. Order Number DE92010770. Source: OSTI; NTIS; GPO Dep.

Intermolecular energy transfer of highly excited polyatomic molecules plays an important role in many complex chemical systems: combustion, high temperature and atmospheric chemistry. By monitoring the relaxation of internal energy we have observed trends in the collisional efficiency (β) for energy transfer as a function of the substrate's excitation energy and the complexities of substrate and deactivator. For a given substrate β increases as the deactivator's mass increase to ~30 amu and then exhibits a nearly constant value; this is due to a mass mismatch between the atoms of the colliders. In a homologous series of substrate molecules (C_3-C_8) β decreases as the number of atoms in the substrate increases; replacing F with H increases β. All substrates, except for CF_2Cl_2 and CF_2HCl below 10,000 cm^{-1}, exhibited that β is independent of energy, i.e. $<\Delta E>_{all}$ is linear with energy. The results are interpreted with a simple model which considers that β is a function of the ocillators energy and its vibrational frequency. Limitations of current approximations used in high temperature unimolecular reactions were evaluated and better approximations were developed. The importance of energy transfer in product yields was observed for the photoactivation of perfluorocyclopropene and the photoproduction of difluoroethyne. 3 refs., 18 figs., 4 tabs.

20287 (INIS-mf-13192, pp. 207-208) **Josephson effects and quantum interference in high-T_C superconductors.** Kuznik, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Kohl, M.; Petricek, V.; Tichy, R. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243-: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments have given evidence that the Ginzburg-Landau theory applies to high-T_C superconductors; the coherence length, however, is considerably shorter than for conventional superconductors, viz., it is of the order of tenths of nm, which is comparable with the lattice parameters. As a consequence, planar defects in crystals such as grain boundaries or domain boundaries are a hindrance to the superconductor current. Thus, polycrystalline ceramic samples as well as single crystals do not behave as homogeneous materials; instead, they behave as systems of superconducting granules mutually bonded by weak Josephson junctions. These phenomena are demonstrated on an $YBa_2Cu_3CO_7$ single crystal. Measurements of magnetization curves in a weak magnetic field using a SQUID magnetometer were useful in examining the Josephson environment. Observation of the individual Josephson junctions inside the ceramics was accomplished on tip contacts. (Z.S.). 5 refs.

20288 (K/ETO–96-Rev.1) **The multiphoton ionization of uranium hexafluoride: Revision 1.** Armstrong, D.P. (Oak Ridge K-25 Site, TN (United States). UEO Enrichment Technical Operations Div.). Oak Ridge K-25 Site, TN (United States). UEO Enrichment Technical Operations Div.; Oak Ridge National Lab., TN (United States). May 1992. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400 ;AC05-76OR00001. Order Number DE92013383. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis. Submitted to University of Tennessee, Knoxville, TN.

Multiphoton ionization (MPI) time-of-flight mass spectroscopy and photoelectron spectroscopy studies of UF_6 have been conducted using focused light from the Nd:YAG laser fundamental (λ=1064 nm) and its harmonics (λ=532, 355, or 266 nm), as well as other wavelengths provided by a tunable dye laser. The MPI mass spectra are dominated by the singly and multiply charged uranium ions rather than by the UF_x^+ fragment ions even at the lowest laser power densities at which signal could be detected. The laser power dependence of U^{n+} ions signals indicates that saturation can occur for many of the steps required for their ionization. In general, the doubly-charged uranium ion (U^{2+}) intensity is much greater than that of the singly-charged uranium ion (U^+). For the case of the tunable dye laser experiments, the U^{n+} (n = 1- 4) wavelength dependence is relatively unstructured and does not show observable resonance enhancement at known atomic uranium excitation wavelengths. The dominance of the U^{2+} ion and the absence or very small intensities of UF_x^+ fragments, along with the unsaturated wavelength dependence, indicate that mechanisms may exist other than ionization of bare U atoms after the stepwise photodissociation of F atoms from the parent molecule.

20289 (LUNFD6-NFFA–1018-1-150-1991) **Time-resolved spectroscopy of radiative and non-radiative decays in multiply charged ions.** Westerlind, M. Lund Univ. (Sweden). Dept. of Physics. Dec 1991. 55p. Order Number DE92628694. Source: OSTI; NTIS (US Sales Only); INIS.

The beam-foil method has been used to investigate atomic structure and decay characteristics like lifetimes and transition probabilities. Studies of transition probabilities in Ne-like ions. These systems have attracted much interest since they are candidates for short-wavelength lasers. Investigation of core-excited states in the Na-isoelectronic sequence. These states are found above the first ionization limit and have a complicated decay scheme, involving both radiative and autoionization modes. Spectroscopic analyses of He- and Na-like systems. Here the emphasis is on obtaining accurate estimates of the quantum electrodynamic contributions to the groundstate energy. Lifetime measurements of multiply excited levels in FV. This study shows how fine details in the atomic structure may drastically affect the lifetimes. Decay properties in Al-like ions. An anomalous intensity ratio between several resonance transitions in the Al isoelectronic sequence is observed experimentally and investigated with different theoretical models. The lifetimes of low-lying quartet levels in Al-like ions have also been measured and compared with theoretical calculations. Spectral analyses of highly ionized bromine. The analyses have extended the earlier studies of Cr-, Mn- and Fe-like Br to incorporate also the lowest excited, metastable configurations.

6645 Special Atoms and Molecules

Refer also to citation(s) 20011

6650 Physics of Condensed Matter

Refer also to citation(s) 18890, 19113, 19375

20290 (CONF-9105202–, pp. 7, Paper 12) **Moving finite elements: A continuously adaptive method for computational fluid dynamics.** Glasser, A.H. (Los Alamos National Lab., NM (United States)); Miller, K.; Carlson, N. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Moving Finite Elements (MFE), a recently developed method for computational fluid dynamics, promises major advances in the ability of computers to model the complex behavior of liquids, gases, and plasmas. Applications of computational fluid dynamics occur in a wide range of scientifically and technologically important fields. Examples include meteorology, oceanography, global climate modeling, magnetic and inertial fusion energy research, semiconductor fabrication, biophysics, automobile and aircraft design, industrial fluid processing, chemical engineering, and combustion research. The improvements made possible by the new method could thus have substantial economic impact. Moving Finite Elements is a moving node adaptive grid method which has a tendency to pack the grid finely in regions where it is most needed at each time and to leave it coarse elsewhere. It does so in a manner which is simple and automatic, and does not require a large amount of human ingenuity to apply it to each particular problem. At the same time, it often allows the time step to be large enough to advance a moving shock by many shock thicknesses in a single time step, moving the grid smoothly with the solution and minimizing the number of time steps required for the whole problem. For 2D problems (two spatial variables) the grid is composed of irregularly shaped and irregularly connected triangles which are very flexible in their ability to adapt to the evolving solution. While other adaptive grid methods have been developed which share some of these desirable properties, this is the only method which combines them all. In many cases, the method can save orders of magnitude of computing time, equivalent to several generations of advancing computer hardware.

20291 (DOE/ER/13738–T2) **[Bifurcations and patterns in nonlinear dissipative systems]: Progress report.** Ahlers, G.; Cannell, D.S. California Univ., Santa Barbara, CA (United States). 26 Feb 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13738. Order Number DE92013502. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Rayleigh-Benard convection with an imposed horizontal flow; Rayleigh-Benard convection in a gas under non-boussinesq conditions; electro- convection in a nematic liquid crystal; and Rayleigh-Benard convection in a nematic liquid crystal. (LSP)

20292 (EGG-WTD–9845) **A computational model for viscous fluid flow, heat transfer, and melting in in situ vitrification melt pools.** McHugh, P.R.; Ramshaw, J.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012215. Source: OSTI; NTIS; INIS; GPO Dep.

MAGMA is a FORTRAN computer code designed to viscous flow in in situ vitrification melt pools. It models three-dimensional, incompressible, viscous flow and heat transfer. The momentum equation is coupled to the temperature field through the buoyancy force terms arising from the Boussinesq approximation. All fluid properties, except density, are assumed variable. Density is assumed constant except in the buoyancy force terms in the momentum equation. A simple melting model based on the enthalpy method allows the study of the melt front progression and latent heat effects. An indirect addressing scheme used in the numerical solution of the momentum equation voids unnecessary calculations in cells devoid of liquid. Two-dimensional calculations can be performed using either rectangular or cylindrical coordinates, while three-dimensional calculations use rectangular coordinates. All derivatives are approximated by finite differences. The incompressible Navier-Stokes equations are solved using a new fully implicit iterative technique, while the energy equation is differenced explicitly in time. Spatial derivatives are written in conservative form using a uniform, rectangular, staggered mesh based on the marker and cell placement of variables. Convective terms are differenced using a weighted average of centered and donor cell differencing to ensure numerical stability. Complete descriptions of MAGMA governing equations, numerics, code structure, and code verification are provided. 14 refs.

20293 (INIS-mf-13178) **Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.** Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991 269p. (CONF-8912137--: Solid state physics symposium, Madras (India), 19-22 Dec 1989). Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are indexed separately.

20294 (JSR-90-310) **Continuum approaches for describing solid-gas and solid-liquid flow.** Diamond, P.; Harvey, J.; Levine, H.; Steinhardt, P.; Westervelt, R. Mitre Corp., McLean, VA (United States). Jason Program Office. Feb 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90ER30174. Order Number DE92013601. Source: OSTI; NTIS; GPO Dep.

Two-phase continuum models have been used to describe the multiphase flow properties of solid-gas and solid-liquid mixtures. The approach is limited in that it requires many fitting functions and parameters to be determined empirically, and it does not provide natural explanations for some of the qualitative behavior of solid-fluid flow. In this report, we explore a more recent single-phase continuum model proposed by Jenkins and Savage to describe granular flow. Jenkins and McTigue have proposed a modified model to describe the flow of dense suspensions, and hence, many of our results can be straight-forwardly extended to this flow regime as well. The solid-fluid mixture is treated as a homogeneous, compressible fluid in which the particle fluctuations about the mean flow are described in terms of an effective temperature. The particle collisions are treated as inelastic. After an introduction in which we briefly comment on the present status of the field, we describe the details of the single-phase continuum model and analyze the microscopic and macroscopic flow conditions required for the approach to be valid. We then derive numerous qualitative predictions which can be empirically verified in small-scale experiments: The flow profiles are computed for simple boundary conditions, plane Couette flow and channel flow. Segregaion effects when there are two (or more) particle size are considered. The acoustic dispersion relation is derived and shown to predict that granular flow is supersonic. We point out that the analysis of flow instabilities is complicated by the finite compressibility of the solid-fluid mixture. For example, the large compressibility leads to interchange (Rayleigh-Taylor instabilities) in addition to the usual angular momentum interchange in standard (cylindrical) Couette flow. We conclude by describing some of the advantages and limitations of experimental techniques that might be used to test predictions for solid-fluid flow. 19 refs.

20295 (LA-12284-T) **Spectral self-similarity of homogeneous anisotropic turbulence.** Clark, T.T. Los Alamos National Lab., NM (United States). Apr 1992. 318p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92013056. Source: OSTI; NTIS; GPO Dep.

Thesis. Submitted to University of New Mexico, Albuquerque.

A spectral model of turbulence is used to study the behavior of homogeneous turbulence subjected to homogeneous mean flow gradients and turbulence which freely decays. The model predictions agree quantitatively with experimental data for turbulence subjected to irrotational strains and qualitatively with experimental data for turbulence subjected to homogeneous shears and freely decaying anisotropic turbulence. The model predicts two different large-time asymptotic states. One state is characteristic of turbulence subjected to time-variant homogeneous mean flow gradients. The other state is characteristic of freely decaying turbulence. For turbulence subjected to homogeneous mean flow gradients, the Reynolds tensor components grow exponentially in time, the Reynolds stress anisotropy becomes constant in time and the spectral tensor approaches a self-similar form. The self-similar spectral shapes depend on the structure of the imposed mean flow gradients and may vary between components of the spectral tensor. For freely decaying anisotropic turbulence the Reynolds tensor components approach a power-law decay in time and the spectral tensor approaches a self-similar form that possesses only two shape function--one for the energy spectrum, and the other for the deviatoric spectral tensor components. The spectral model predicts the experimentally observed variations in rates of return to isotropy. Based on these predictions, it is argued that experimentally observed variations in the rates of return to isotropy may be explained as a spectral transition. During straining the experiments the turbulence tends toward the self-similar form characteristic of the imposed strain.

20296 (UCRL-JC-108753) **Self-consistent-field KKR-CPA calculations in the atomic-sphere approximations.** Singh, P.P. Gonis, A. (Lawrence Livermore National Lab., CA (United States)); de Fontaine, D. Lawrence Livermore National Lab., CA (United States). 3 Dec 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC03-76SF00098. (CONF-911202-73: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92011525. Source: OSTI; NTIS; GPO Dep.

We present a formulation of the Korringa-Kohn-Rostoker coherent potential approximation (KKR-CPA) for the treatment of substitutionally disordered alloys within the KKR atomic-sphere approximations (ASA). This KKR-ASA-CPA represents the first step toward the implementation of a full cell potential CPA, and combines the accuracy of the KKR-CPA method with the flexibility of treating complex crystal structures. The accuracy of this approach has been tested by comparing the self-consistent-field (SCF) KKR-ASA-CPA calculations of Cu-Pd alloys with experimental results and previous SCF-KKR-CPA calculations.

20297 (UCRL-JC-109001) **The Green Function Cellular Method and its relation to multiple scattering theory.** Butler, W.H. (Oak Ridge National Lab., TN (United States)); Zhang, X.G.; Gonis, A. Lawrence Livermore National Lab., CA (United States). 13 Nov 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC05-84OR21400. (CONF-911202-69: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92011470. Source: OSTI; NTIS; GPO Dep.

We investigate techniques for solving the wave equation which are based on the idea of obtaining exact local solutions within each potential cell, which are then joined to form a global solution. We derive full potential multiple scattering theory (MST) from the Lippmann-Schwinger equation and show that is as well as a closely related cellular method are techniques of this type. This cellular method appears to have all of the advantages of MST and the added advantage of having a secular matrix with only nearest neighbor interactions. Since this cellular method is easily linearized one can rigorously reduce electronic structure calculations to the problem of solving a nearest neighbor tight-binding problem.

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Refer also to citation(s) 18832, 18974, 19025, 19282, 19283, 19571, 19577, 20270, 20339, 20346

20298 (BNL-47318) **Surface electronic structure of GaAs(110) studied by Auger photoelectron coincidence spectroscopy.** Bartynski, R.A. (Rutgers-the State Univ., Piscataway, NJ (United States)); Garrison, K.; Jensen, E.; Hulbert, S.L.; Weinert, M. Brookhaven National Lab., Upton, NY (United States). [1990]. 16p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016. Grant-DMR-85-19059. (CONF-901035-22: 37. national American Vacuum Society symposium, Toronto (Canada), 8-12 Oct 1990; RU-57-90). Order Number DE92012211. Source: OSTI; NTIS; GPO Dep.

We have used Auger photoelectron coincidence spectroscopy to study the $M_{4,5}VV$ Auger spectra of GaAs(110). Using this technique, the Ga and As spectra can be separated and studied independently. The lineshape of the As-$M_{4,5}VV$ measured in coincidence with the As 3d photoemission line differs significantly from the conventional Auger spectrum. We attribute this to the surface electronic properties of the system. In addition, we have found that the ss-component of the As spectrum is more intense than expected based on calculations using atomic matrix elements. The Ga-$M_{4,5}VV$ spectrum, of which only the pp-component is observed, agrees well with that expected from an independent electron model. A first principles electronic structure calculation of a 5-layer GaAs(110) slab has been performed to aid in the interpretation of the Auger spectra.

20299 (CONF-9109256–2) **Sub-Å microscopy through incoherent imaging and image reconstruction.** Pennycook, S.J. (Oak Ridge National Lab., TN (United States)); Jesson, D.E.; Chisholm, M.F.; Ferridge, A.G.; Seddon, M.J. Oak Ridge National Lab., TN (United States). Mar 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. Pfefferkorn conference on signal and image processing in microscopy and microanalysis; Cambridge (United Kingdom); 16-19 Sep 1991. Order Number DE92011787. Source: OSTI; NTIS; INIS; GPO Dep.

Z-contrast scanning transmission electron microscopy (STEM) with a high-angle annular detector breaks the coherence of the imaging process, and provides an incoherent image of a crystal projection. Even in the presence of strong dynamical diffraction, the image can be accurately described as a convolution between an object function, sharply peaked at the projected atomic sites, and the probe intensity profile. Such an image can be inverted intuitively without the need for model structures, and therefore provides the important capability to reveal unanticipated interfacial arrangements. It represents a direct image of the crystal projection, revealing the location of the atomic columns and their relative high-angle scattering power. Since no phase is associated with a peak in the object function or the contrast transfer function, extension to higher resolution is also straightforward. Image restoration techniques such as maximum entropy, in conjunction with the 1.3 Å probe anticipated for a 300 kV STEM, appear to provide a simple and robust route to the achievement of sub-Å resolution electron microscopy.

20300 (CONF-9110340–) **DOE/DMS workshop on future synchrotron VUV and x-ray beam Lines.** Green, P.H. (comp.). Oak Ridge National Lab., TN (United States). Mar 1992. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From DOE/DMS workshop on future synchrotron VUV X-ray beam lines; Gatlinburg, TN (United States); 21-23 Oct 1991. Order Number DE92011883. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains an overview of the participating DOE Laboratory beam line interests and the projected science to be addressed on these beam lines, both at new and existing synchrotron facilities. The scientific programs associated with present and planned synchrotron research by DOE Laboratories are discussed in chapters titled "VUV and Soft X-Ray Research" and "Hard X-Ray Research." This research encompasses a broad range of the nation's scientific and technical research needs from fundamental to applied, in areas including environmental, biological, and physical sciences; new materials; and energy-related technologies. The projected cost of this proposed construction has been provided in tabular form using a uniform format so that anticipated DOE and outside funding agency contributions for construction and for research and development can be determined. The cost figures are, of course, subject to uncertainties of detailed design requirements and the availability of facility-designed generic components and outside vendors. The report also contains a compendium (as submitted by the beam line proposers) of the design capabilities, the anticipated costs, and the scientific programs of projected beam line construction at the four synchrotron facilities. A summary of the projected cost of these beam lines to be requested of DOE is compiled.

20301 (CONF-9110359–1) **High-resolution imaging in the scanning transmission electron microscope.** Pennycook, S.J.; Jesson, D.E. Oak Ridge National Lab., TN (United States). Mar 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International school on electron microscopy in materials science; Brindisi (Italy); 7-11 Oct 1991. Order Number DE92010647. Source: OSTI; NTIS; INIS; GPO Dep.

The high-resolution imaging of crystalline materials in the scanning transmission electron microscopy (STEM) is reviewed with particular emphasis on the conditions under which an incoherent image can be obtained. It is shown that a high-angle annular detector can be used to break the coherence of the imaging process, in the transverse plane through the geometry of the detector, or in three dimensions if multiphonon diffuse scattering is detected. In the latter case, each atom can be treated as a highly independent source of high-angle scattering. The most effective fast electron states are therefore tightly bound s-type Bloch states. Furthermore, they add constructively for each incident angle in the coherent STEM probe, so that s states are responsible for practically the entire image contrast. Dynamical effects are largely removed, and almost perfect incoherent imaging is achieved. s states are relatively insensitive to neighboring strings, so that incoherent imaging is maintained for superlattice and interfaces, and supercell calculations are unnecessary. With an optimum probe profile, the incoherent image represents a direct image of the crystal projection, with compositional sensitivity built in through the strong dependence of the scattering cross sections on atomic number Z.

20302 (HMI-B–493) **Neutron scattering-instrumentation at the upgraded research reactor BER II. Berlin Neutron Scattering Center - BENSC, October 1991.** Hahn-Meitner-Institut Berlin GmbH (Germany). 1991. 52p. Order Number DE92517034. Source: OSTI; NTIS (US Sales Only); INIS.

The Berlin Neutron Scattering Centre (BENSC) is a newly created special department of the Hahn-Meitner-Institut, in the framework of which the BER II neutron beam reactor is made available to external users. BENSC is devoted to development, continuous modernisation and maintenance of the scientific instrumets at the BER II and to the support of their users. (orig./HSI).

20303 (INIS-mf–13178, pp. 121-137) **Concepts, techniques and applications of point-contact spectroscopy.** Raychaudhuri, A.K. (Indian Inst. of Science, Bangalore (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

Point-contact spectroscopy is a powerful tool to study spectrum of elementary excitations in solid. In the past decade this particular form of spectroscopy has been applied to a number of well defined problems in solid state physics, like, studies of phonons, magnetic excitations, internal field in spin glasses, heavy fermion systems etc. In recent years this technique is being widely used to search for superconducting energy gap in high Tc materials. The basic physical concepts behind such experiments are stated and techniques and representative results are discussed. In particular recent results obtained on normal and superconducting oxides with a point-contact apparatus working in a field upto 8 Tesla and down to a temperature 1.5 K are discussed. It is shown how such point contact set up can be used to make ultralow capacitance tunnel junction ($\approx 10^{-18}$-10^{-19}Farad) so that interesting phenomena like single electron tunneling can be observed. (author). 19 refs., 5 figs.

20304 (INIS-mf–13178, pp. 138-150) **X-ray studies on protein structures.** Ramanadham, M. (Bhabha Atomic Research Centre, Bombay (India). Solid State Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

Proteins are involved practically at every stage of biological organization and interactions. X-ray diffraction studies on protein structures are aimed at understanding and interpreting a vast majority of biological phenomena at molecular level. This subject, initiated during the second quarter of this century, has played a pivotal role in enhancing knowledge of the life processes, such as the enzyme activity, control and expression of genetic information, immune response and others. Thanks to the improved techniques of sample preparation, availability of high-intensity X-ray sources, fast digital computers with larger memories and interactive graphics systems, many new methods of structure analysis and interpretation are being attempted, and more and more complex biomolecular systems are being investigated in recent years. A reinvestigation of the phase problem, optimization of molecular models by augmenting the diffraction data with other extra-crystallographic information (energy and geometry restraints, etc.); the use of real-time graphics techniques for model interpretation and editing, etc., are some of the recent developments that need special mention. (author). 37 refs.

20305 (INIS-mf--13192, pp. 29-30) **Application of Moessbauer spectroscopy in technical practice.** Sitek, J. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta); Lipka, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A succinct account is given of analytical applications of Moessbauer spectroscopy to the following materials: steel works flue dust, polymetallic concentrates, special steels, nuclear power plant corrosion products, magnetic strips, and coal. (Z.S.). 1 ref.

20306 (INIS-mf--13192, pp. 161-162) **Phase analysis using Moessbauer spectroscopy.** Zemcik, T. (Ceskoslovenska Akademie Ved, Brno (Czechoslovakia). Ustav Fyzikalni Metalurgie). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The Moessbauer effect - mostly on ^{57}Fe nuclei - proves to be a powerful tool for the phase analysis of alloys and other materials, e.g. mineral systems. The potential of both qualitative and quantitative Moessbauer phase analysis is demonstrated on examples of steels and soft magnetic alloys and briefly compared with other methods. (author). 2 figs., 1 tab.

20307 (INIS-mf--13192, pp. 246) **Polarized neutron diffraction on high quality magnetic crystals.** Kulda, J. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MAGNETIC MATERIALS/neutron diffraction; POLARIZED BEAMS

20308 (INIS-mf--13192, pp. 246) **On the practical use of neutron beam optics.** Mikula, P. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky); Kulda, J.; Lukas, P.; Sedlakova, L. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BEAM OPTICS/neutron diffractometers; CRYSTALS; NEUTRON DIFFRACTION

20309 (INIS-mf--13192, pp. 255) **X-ray diffraction from silicon surface modified by ArF excimer laser pulse.** Kopecky, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Krousky, E.; Lukes, I.; Renner, O. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SILICON/x-ray diffraction; CRYSTALS; LASER RADIATION; SILICON; SURFACES

20310 (INIS-mf--13192, pp. 255) **X-ray study of structural defects in a semiconductor superlattice.** Kubena, J. (Universita J.E. Purkyne, Brno (Czechoslovakia). Prirodovedecka Fakulta); Holy, V. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SEMICONDUCTOR MATERIALS/microstructure; MICROSTRUCTURE; SUPERLATTICES; X-RAY DIFFRACTION

20311 (INIS-mf--13192, pp. 255) **Moessbauer study of amorphous FeCoSiB: Time dependent thermal stability.** Sitek, J. (Department of Nuclear Physics and Technology, Bratislava (Czechoslovakia)); Miglierini, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MOESSBAUER EFFECT; AMORPHOUS STATE; ANNEALING; BORON COMPOUNDS; COBALT COMPOUNDS; IRON COMPOUNDS; SILICON COMPOUNDS

20312 (INIS-mf--13192, pp. 255) **Moessbauer study of amorphous FeCrSiB: Homogeneity of the ribbon.** Miglierini, M. (Department of Nuclear Physics and Technology, Bratislava (Czechoslovakia)); Sitek, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MOESSBAUER EFFECT/microstructure; AMORPHOUS STATE; BORON COMPOUNDS; CHROMIUM COMPOUNDS; IRON COMPOUNDS; MICROSTRUCTURE; SILICON COMPOUNDS

20313 (INIS-mf--13192, pp. 256) **Neutron diffraction on metallic glass.** Kristiakova, K. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Kristiak, J.; Duhaj, P.; Pacher, P.; Simkin, V. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. METALLIC GLASSES/neutron diffraction; MICROSTRUCTURE; NEUTRON SPECTRA

20314 (INIS-mf--13192, pp. 265) **The penetration depth in ceramic BiSrCaCuO measured by muon spin rotation.** Kapusta, S. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Niznansky, D.; Hanslik, T.; Burianek, J.; Sichova, H.; Zhukov, V.A.; Pomyakushin, V.Yu.; Ponomarev, A.N. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/penetration depth; PENETRATION DEPTH/muon spin relaxation; CERAMICS

20315 (INIS-mf--13192, pp. 265) **X-ray phase analysis of Bi-Sr-Ca-Cu-O high-T_C superconductors.** Rusek, J. (Ceskoslovenska Akademie Ved, Olomouc (Czechoslovakia). Hornicky Ustav); Filip, P.; Kucirek, P.; Kubinek, R. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243--: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/phase studies; X RADIATION

20316 (INIS-mf–13192, pp. 268) **Study of nanocrystalline ribbons by the Moessbauer spectroscopy.** Petrovic, P. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovedecka Fakulta); Brovko, I.; Zatroch, M.; Svec, T.; Konc, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOYS/moessbauer effect; ALLOYS; AMORPHOUS STATE; ANNEALING; CRYSTALLIZATION; SPECTROSCOPY

20317 (INIS-mf–13192, pp. 268) **Moessbauer spectroscopy investigation of the hydrogenated amorphous alloys.** Petrovic, P. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovedecka Fakulta); Zatroch, M.; Brovko, I.; Svec, T.; Konc, M. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOYS/moessbauer effect; ALLOYS; AMORPHOUS STATE; HYDROGEN; SPECTROSCOPY

20318 (INIS-mf–13192, pp. 271) **Nuclear magnetic resonance in drawn polypropylene fibres.** Mucha, L. (Vysoka Skola Technicka, Kosice (Czechoslovakia)); Murin, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FIBERS/nuclear magnetic resonance; FIBERS; MICROSTRUCTURE; POLYPROPYLENE

20319 (INIS-mf–13192, pp. 271) **Nuclear magnetic relaxation in polyamide-6.** Kiralvarga, M. (Vysoka Skola Technicka, Kosice (Czechoslovakia)); Murin, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYAMIDES/nuclear magnetic resonance; POLYAMIDES; SPIN-LATTICE RELAXATION; TEMPERATURE DEPENDENCE

20320 (INIS-mf–13192, pp. 272) **Moessbauer spectroscopy of RPV steels.** Broz, D. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Anorganicke Chemie); Haba, Z.; Strakova, J.; Kocik, J.; Sedlak, B. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. STEELS/moessbauer effect; PRESSURE VESSELS; SPECTROSCOPY; STEELS

20321 (KEK-PROC–91-9) **Proceedings of the workshop on scattering experiments under extreme conditions.** Sakai, N. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)); Ikeda, H.; Ando, M. (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1991. 143p. (In Japanese). (CONF-9010489–: Workshop on scattering experiments under extreme conditions, Tsukuba (Japan), 12-13 Oct 1990). Order Number DE92515058. Source: OSTI; NTIS (US Sales Only); INIS.

In the National Laboratory for High Energy Physics (KEK), as the research facilities, there are Photon Factory, the facility for utilizing the booster and University of Tokyo Meson Science Research Center. For the research on physical properties, it is very important to do structural analysis in a broad sense and to observe the behavior of quasiparticles in solids. The X-ray and pulsed neutrons required for these researches can be obtained in a single laboratory in KEK, and it is rare in the world. At this opportunity of the workshop on scattering experiments under extreme conditions, it is hoped that the positive interchange between both PF and booster groups will be carried out. The research on magnetic substances using X-ray is a most noteworthy utilization of synchrotron radiation. The discovery of X-ray resonance magnetic scattering by K. Namikawa is one of the remarkable researches using synchrotron radiation in the world. When the extreme conditions around samples are prepared, the quality of signals for the research on physical properties is to be heightened. In this report, the researches on physical properties under ultrahigh pressure and ultralow temperature are reported. (K.I.).

20322 (KIYaI–89-34) **The neutron localization at magnetic field nonuniformities in superconductors.** Rud'ko, V.N.; Sugakov, V.I.; Shevtsova-Kaz'mirchuk, O.N. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1989. 11p. (In Russian). Order Number DE92627517. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of existence of the neutron surface states at the interface of a superconductor and a normal metal (or insulator) placed in the magnetic field is investigated. It is shown that in the superconducting lanthanum ceramics at the boundaries of superconducting and insulator phases in the magnetic field close to B_{c1} the surface states of neutrons exist. The possibility of neutron channeling along the flux line in the mixed state superconductor is studied. 16 refs.; 2 figs.

20323 (KIYaI–90-16) **Method of slow neutrons inelastic scattering in investigations of crystal electric field effects.** Vasil'kevich, A.A.; Ivanitskij, P.G.; Krotenko, V.T.; Majstrenko, A.N.; Slisenko, V.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 17p. (In Russian). Order Number DE92627518. Source: OSTI; NTIS (US Sales Only); INIS.

The procedure of investigations of crystal electric field (CEF) effects by the method of slow neutron inelastic scattering has been described. The results are presented on determination of Hamiltonian parameters of CEF for compound of Ce_3Al_{11} by the given method. The scheme of levels of the main multiplet $_3H^4$ of Ce^{3+} ion in the investigated compound is reduced and the magnetic part of specific heat (Schottky specific heat) depending on the temperature. 14 refs.; 3 figs.; 1 tab.

20324 (LNS–161) **Neutron scattering (progress report) January - December 1991.** Buehrer, W. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Fischer, P.; Furrer, A. (eds.). Eidgenoessische Technische Hochschule, Zuerich (Switzerland). Lab. fuer Neutronenstreuung. Feb 1992. 171p. (In German, English). Order Number DE92627519. Source: OSTI; NTIS (US Sales Only); INIS.

Progress made by the Laboratory for Neutron Scattering of the Swiss Federal Institute of Technology during the year 1991 in the fields of high-T_c superconductors, materials science, magnetism, structural research, lattice dynamics, phase transitions, instrumental and support activities is reported. figs., tabs., refs.

20325 (NEI-DK–836) **Risoe activity within the CEC SOFC programme: Measurement of internal stresses by neutron diffraction.** Toftegaard, H.; Leffers, T.; Poulsen, F.W. Risoe National Lab., Roskilde (Denmark). Materials Dept. Oct 1991 14p. Contract EN3E-0178-DK. Order Number DE92628746. Source: OSTI; NTIS (US Sales Only); INIS.

The objective was to design, fabricate and test a neutron diffraction equipment for measurements of internal stresses in SOFC components with high spatial resolution, and use the best suited equipment to measure internal stresses in SOFC components from other participants in the programme. Two different geometries and two different materials (Al_2O_x and YSZ) were examined in order to investigate: the diffracted intensity as related to the diffracting volume, the diffracted intensity as related to the position of the sample relative to the slit arrangement, and the accuracy of the strain measurement. It was found that the beam collimation by two pairs of double slits increases and the diffraction efficiency decreases with decreased slit width, the diffracting volume is fairly well defined by the two pairs of double slits, and the accuracy in the determination of the internal stresses is adequate. With the equipment for high spatial resolution it is possible to measure lattice spacing in volumes of YSZ down to 1-10 mm^3. Residual strains were measured for NiO, LSM and YSZ of a planar Risoe 3-layer cell (anode NiO/YSZ, electrode YSZ, cathode LMS/YSZ). Each layer was 42 by 42 by 0.1 mm. Slit widths from 10 to 20 mm were used. The best suited equipment was a combination of Soller slits (thin, neutron absorbing, parallel plates) and a double slit for both the incident and the diffracted beam. The measured residual strains for the components of the cell are: $300x10^{-6}$ (tension) for NiO, $700x10^{-6}$ (tension) for LSM and less than $450x10^{-6}$ (compression) for YSZ. (AB).

20326 (RAL–91-096) **Detection of quadrupole interactions by muon level crossing resonance.** Cox, S.F.J. Rutherford Appleton Lab., Chilton (United Kingdom). Dec 1991. 17p. (CONF-910776–: 11. international symposium on nuclear quadrupole resonance spectroscopy (ISNQRS-11), London (United Kingdom), 15-19 Jul 1991). Order Number DE92627520. Source: OSTI; NTIS (US Sales Only); INIS.

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The positive muon proves to be a very versatile and sensitive magnetic resonance probe: implanted in virtually any material its polarisation may be monitored via the asymmetry in its radioactive decay, giving information on the sites occupied by the muon in lattices or molecules, and the local fields experienced at these sites. The scope of these experiments has been greatly extended by the development of a technique of cross relaxation or level crossing resonance which allows quadrupole splittings on nuclei adjacent to the muon to be measured. The principles of the technique, and the conditions necessary for detection of the spectra, are described, together with a number of applications. Studies of the muon level crossing resonance in copper have given valuable information on the crystallographic site, electronic structure and low temperature mobility of the interstitial defect. In semiconductors, muons are expected to trap at other impurities -notably acceptors - in processes analogous to the passivation of dopants by hydrogen. Muons implanted in ice produce a significant change in the quadrupole coupling constant of adjacent ^{17}O nuclei which may be traced to the effects of the large muon zero point energy; the resonance spectrum also exhibits temperature dependent features which may be informative on the nature and lifetime of defects in the ice structure. Muon level crossing resonance has already been studied in an oxide superconductor and this relatively young field is now wide open for quadrupole interaction studies in other materials, using a variety of nuclei. (author).

20327 (RAL–92-002) **Muon beams, used for studying the solid state.** Cox, S.F.J. (Rutherford Appleton Lab., Chilton (United Kingdom)); Stoneham, A.M. Rutherford Appleton Lab., Chilton (United Kingdom). Jan 1992. 11p. Order Number DE92628747. Source: OSTI; NTIS (US Sales Only); INIS.

Article commissioned for the Encyclopaedia of Materials Science and Engineering.

The positive muon provides a remarkable spectroscopic probe of the solid state. Implanted in virtually any material, its spin polarisation may be monitored to define the sites it occupies in lattices or molecules and to report on local structure and dynamics. Wide ranging applications in solid state science are illustrated in this article by examples in magnetics, chemistry and quantum diffusion. Primarily, the muon is a sensitive microscopic magnetometer: this elementary particle has spin 1/2 and a magnetic moment about three times that of the proton. The frequencies of its resonance or precession signals provide a direct and accurate measurement of local magnetic or hyperfine fields. Its relaxation functions characterise the distribution in space or the fluctuation in time of these fields. The muon is rarely a passive probe, however, since it represents a defect carrying unit positive charge. In fact its interactions with the local environment are commonly the main focus of interest; studies of this most fundamental of defects have eliminated complacency in several areas. The interactions, chemical and elastic, are essentially identical with those of the proton, so that their study is invaluable in situations where hydrogen cannot be detected by conventional spectroscopies. Alternatively, when muon and proton behaviour may be compared, the comparison reveals a variety of kinetic and dynamic isotope effects: the muon has about one ninth the proton mass. This order of magnitude ratio greatly facilitates identification of specifically quantum effects, ie those including zero point energy or tunnelling. (author).

20328 (RAL–92-014) **Geometric (Berry) phases in neutron molecular spectroscopy.** Lovesey, S.W. Rutherford Appleton Lab., Chilton (United Kingdom). Feb 1992. 11p. Order Number DE92628748. Source: OSTI; NTIS (US Sales Only); INIS.

A theory of neutron scattering by nuclei in a molecule, accompanied by an electronic transition, is formulated with attention to gauge potentials and geometric phases in the Born-Oppenheimer scheme. Non-degenerate and nearly degenerate electronic levels are considered. For nearly degenerate levels it is shown that, the cross-section is free of the singular structure which characterizes the corresponding gauge potential for the phase, and much larger than for well separated electronic states. (author).

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20329 (DOE/ER/45208–7) **He atom-surface scattering: Surface dynamics of insulators, overlayers and crystal growth: Progress report, May 1, 1991–Aprill 30, 1992.** Florida State Univ., Tallahassee, FL (United States). [1992]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER45208. Order Number DE92011810. Source: OSTI; NTIS; INIS; GPO Dep.

Investigations in this laboratory have focused on the surface structure and dynamics of ionic insulators and on epitaxial growth onto alkali halide crystals. In the later the homoepitaxial growth of NaCl/NaCl(001) and the heteroepitaxial growth of KBr/NaCl(001), NaCl/KBr(001) and KBr/RbCl(001) have been studied by monitoring the specular He scattering as a function of the coverage and by measuring the angular and energy distributions of the scattered He atoms. These data provide information on the surface structure, defect densities, island sizes and surface strain during the layer-by-layer growth. The temperature dependence of these measurements also provides information on the mobilities of the admolecules. He atom scattering is unique among surface probes because the low-energy, inert atoms are sensitive only to the electronic structure of the topmost surface layer and are equally applicable to all crystalline materials. It is proposed for the next year to exploit further the variety of combinations possible with the alkali halides in order to carry out a definitive study of epitaxial growth in the ionic insulators. The work completed so far, including measurements of the Bragg diffraction and surface dispersion at various stages of growth, appears to be exceptionally rich in detail, which is particularly promising for theoretical modeling. In addition, because epitaxial growth conditions over a wide range of lattice mismatches is possible with these materials, size effects in growth processes can be explored in great depth. Further, as some of the alkali halides have the CsCl structure instead of the NaCl structure, we can investigate the effects of the heteroepitaxy with materials having different lattice preferences. Finally, by using co-deposition of different alkali halides, one can investigate the formation and stability of alloys and even alkali halide superlattices.

20330 (INIS-mf–13192 p5-p8) **Ion implantation.** Antoncik, E. (Aarhus Univ. (Denmark). Inst. of Physics). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The principles of the ion implantation technique are outlined. The apparently anomalous behavior of some implanted ions in silicon during annealing is discussed. The unusual diffusion behavior of boron atoms in silicon in dependence on the duration of the annealing process is demonstrated, as is the dependence of the formation of acceptors on the annealing time. (Z.S.). 2 figs.

20331 (INIS-SU–309/A, pp. 113-126) **State-of-the-art and trends of developement of semiconductor radiation physics.** Mordkovich, V.N.; Shakhovtsev, V.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

The state of theories describing fundamental properties of primary radiation defects (RD) in diamond-like semiconductors as well as their interaction with impurities and with one another, giving rise to secondary RD are analyzed. Effectiveness of formation of secondary RD are evaluated. Boundaries of applicability of methods of doping with various impurities for controlling RD formation and accumulation processes are estimated. New data on the effect of thermal defects (TD) on the RD behaviour demonstrate that mechanisms of interaction of the latter with TD and with 'chemical' donors are basically different. 31 refs.; 9 figs.

20332 (INIS-SU--309/A, pp. 149-155) **On the initial radiation-induced defect lifetime in silicon.** Krajchinskij, A.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Ostashko, N.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247--: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

An attempt was made to determine some parameters of movement of vacancies and interstitials under silicon crystal irradiation by high-power electron pulses. Irradiation of n-type silicon samples doped with phosphorus was conducted by 3 MeV electron single pulses with 3.7 ms duration. Relaxation of nonequilibrium conductivity induced by electron pulse was measured. It is shown that diffusion coefficients of vacancy and interstitial exceed similar equilibrium values by several orders at room temperature under conditions of strong ionization of electron subsystem of silicon crystals. 7 refs.; 4 figs.

20333 (LA-UR--92-792) **X-ray streak camera diagnostics of picosecond laser-plasma interactions.** Cobble, J.A.; Fulton, R.D.; Jones, L.A.; Kyrala, G.A.; Schappert, G.T.; Taylor, A.J.; Wahlin, E.K. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362--14: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011371. Source: OSTI; NTIS; INIS; GPO Dep.

An x-ray streak camera is used to diagnose a laser-produced Al plasma with time resolution of ~10 ps. A streak record of filtered emission and a time-integrated transmission grating spectrum reveal that the plasma radiation is dominated by emission from He- and H-like resonance lines. 11 refs.

20334 (LA-UR--92-989) **Laser-ablation processes.** Dingus, R.S. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920124--19: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 1 Order Number DE92011226. Source: OSTI; NTIS; GPO Dep.

The various mechanisms by which ablation of materials can be induced with lasers are discussed in this paper. The various ablation processes and potential applications are reviewed from the threshold for ablation up to fluxes of about 10^{13} W/cm^2, with emphasis on three particular processes; namely, front-surface spallation, two-dimensional blowoff, and contained vaporization.

20335 (RISO-R--591) **Erosion of volatile elemental condensed gases by keV electron and light-ion bombardment.** Schou, J. Risoe National Lab., Roskilde (Denmark). Physics Dept. Nov 1991. 159p. Order Number DE92628753. Source: OSTI; NTIS (US Sales Only); INIS.

Erosion of the most volatile elemental gases by keV electron and light-ion bombardment has been studied at the experimental setup at Risoe. The present work includes frozen neon, argon, krypton, nitrogen, oxygen and three hydrogen isotopes, deuterium, hydrogen deuteride and hydrogen. The yield of these condensed gases has been measured as a function of film thickness and primary energy for almost all combinations of primary particles (1-3 keV electrons, 5-10 keV hydrogen- and helium ions) and ices. These and other existing results show that there are substantial common features for the sputtering of frozen elemental gases. Within the two groups, the solid rare gases and the solid molecular gases, the similarity is striking. The hydrogenic solids deviate in some respects from the other elements. The processes that liberate kinetic energy for the particle ejection in sputtering are characteristic of the specific gas. (au) 3 tabs., 12 ills., 159 refs.

20336 (UCRL-JC--109627) **Photon absorption and the decay of surface excitation on sapphire $(11\bar{2}0)$-(3 × 1).** Hamza, A.V.; Hughes, R.S. Jr.; Chase, L.L.; Lee, H.W.H. Lawrence Livermore National Lab., CA (United States). Oct 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911064--9: SPIE International Society for Optical Engineering meeting, Boulder, CO (United States), 23-25 Oct 1991). Order Number DE92011533. Source: OSTI; NTIS; GPO Dep.

A laser-based two-pulse correlation technique is used to investigate the mechanisms of photon absorption and the decay of surface excitation on Al_2O_3(1120). The mechanism for emission of positive or neutral particles depends on the wavelength and/or pulsewidth. In our previous study for a pulsewidth of 80 picoseconds at 1064 nm the lifetime of the surface excitation leading to detectable emission and further to optical surface damage was measured to be ~200 picoseconds. However, for 800 femtosecond pulses at 616 nm the measured lifetime is a few nanoseconds. In both cases a low-order absorption process is indicated.

20337 (UCRL-JC--110159) **Laser-induced desorption from sapphire surfaces.** Hamza, A.V.; Schildbach, M.A. Lawrence Livermore National Lab., CA (United States). Mar 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920462--1: Workshop on disabsorption induced by electronic transitions, Taos, NM (United States), 1-4 Apr 1992). Order Number DE92012698. Source: OSTI; NTIS; GPO Dep.

Laser-induced desorption of energetic (~7eV) aluminum ions was observed from clean and water-covered sapphire (1102) surfaces using time-of-flight mass spectrometry with laser wavelengths of 1064, 355, and 266 nm. In sharp contrast, O^+ (H^+ and OH^+) ions were observed in electron-induced desorption measurements with 300 eV electrons from the bare (water- covered) (1102) surface. Sapphire surfaces were characterized with low energy electron diffraction, reflection electron energy loss spectroscopy, and Auger electron spectroscopy. 8 refs.

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Refer also to citation(s) 19957, 19996

665410 Superconductivity

Refer also to citation(s) 18726, 18828, 18931, 18944

20338 (ANL/ESD/TM--27) **Potential impact of high temperature superconductors on maglev transportation.** Hull, J.R. Argonne National Lab., IL (United States). Energy Systems Div. Feb 1992. 21p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012683. Source: OSTI; NTIS; GPO Dep.

This report describes the potential impact that high-temperature superconductors (HTSs) may have on transportation by magnetically levitated vehicles. It is not intended as a planning document, but rather as an overview of potential HTS applications to magnetic-levitation (maglev) transportation. The present maglev program in the United States is summarized, and the present status of development of HTSs is described. Areas identified for possible impact on maglev technology are (1) liquid-nitrogen-cooled levitation magnets, (2) magnetic-field shielding of the passenger compartment, (3) superconducting magnetic energy storage for wayside power, (4) superconducting bearings for flywheel energy storage for wayside power, (5) downleads to continuously powered liquid-helium-cooled levitation magnets, and (6) liquid-hydrogen-cooled levitation magnets and linear motor propulsion windings. Major technical issues that remain to be resolved for the use of HTSs in maglev applications include thermal magnetic stability, mechanical properties, and critical current density at liquid-nitrogen temperatures.

20339 (INIS-mf–13178, pp. 163-186) **Positron annihilation studies on high temperature superconductors.** Sundar, C.S. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India). Materials Science Div.); Bharathi, A. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

The results of positron annihilation measurements as a function of temperature, across Tc, in a variety of high temperature superconductors such as Y-Ba-Cu-O (Y1237), Y-Ba-Cu-O (Y1248), Bi-Sr-Ca-Cu-O, Tl-Ba-Ca-Cu-O, Ba-K-Bi-O and Nd-Ce-Cu-O are presented. It is shown that the variation of annihilation parameters in the superconducting state is correlated with the diposition of the positron density distribution with respect to the superconducting CuO planes. An increase in positron lifetime is observed below Tc when the positrons probe the CuO planes whereas a decrease in lifetime is observed when the positron density overlaps predominantly with the apical oxygen atom. With this correlation, the different temperature variation of annihilation parameters, seen in the various high temperature superconductors, is understood in terms of a local charge transfer from the planar oxygen atom to the apical oxygen atom. The significance of these results in the context of various theoretical models of high temperature superconductivity is discussed. In addition, the application of positron annihilation spectroscopy to the study of oxygen defects in the Y-Ba-Cu-O, Bi-Sr-Ca-Cu-O and Nd-Ce-Cu-O is presented. (author). 53 refs., 17 figs., 2 tabs.

20340 (INIS-mf–13178, pp. 187-202) **Josephson tunneling studies in high Tc superconductors.** Gupta, A.K. (National Physical Lab., New Delhi (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

The work done on Josephson tunneling in high temperature superconductors is reviewed. Fabrication and performance of SQUIDS and other Josephson junction devices are described. (author). 102 refs., 15 figs.

20341 (INIS-mf–13178, pp. 203-227) **Superconductivity in strongly correlated systems with local electron-phonon interaction.** Das, A.N. (Saha Institute of Nuclear Physics, Calcutta (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

The study of the strongly correlated system has gained a lot of interest after the discovery of the high-Tc oxide systems. Recent experiments point out the importance of local electron-phonon interaction in the high-Tc systems and possibility of polaron formation. In view of the above, an effective hamiltonian, which results from the Hubbard model with strong on-site Coulomb interaction and in presence of local electron-phonon coupling, is studied using the Gutzwiller approximation (GA) and the X-operator technique for the extended s- and d-wave superconductivity in an anisotropic 3-dimensional system. A comparison of the results obtained by the GA and the X-operator technique points out that the latter approximation, which preserves the local constraints, is more appropriate to study superconductivity in strongly correlated systems. The X-operator technique predicts the s-wave superconductivity for both low and high hole concentrations whereas the d-wave superconductivity is stable in the intermediate hole concentration region. Here the hole concentration is measured in excess to the undoped material having one electron (or hole) per site (n=1). Tc for the s-wave is higher for a nearly empty band than for an almost half-filled band. The anisotropy in the hopping and pairing interaction has more effect on the s- than on the d-wave superconductivity. For low as well as for high hole concentration, i.e. for n $\approx$1 and n $\approx$0, the superconducting transition temperature Tc for the s-wave pairing decreases as the inter-planar coupling increases. The effective mass of the polarons, determined using the two-phonon coherent state for the phonon subsystem, is very high for low as well as for high hole concentrations. For the intermediate hole concentration the effective mass is much lower compared to the low-filling case. The implication for high-Tc superconductors are discussed. (author). 50 refs., 8 figs.

20342 (INIS-mf–13192, pp. 27-28) **Study of high-T_C superconductors and amorphous materials by positron annihilation.** Kristiak, J. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Two methods of annihilation investigation, viz., measurement of the positron lifetimes and measurement of the Doppler broadening of the annihilation line, were applied to the study of properties of high-temperature superconductors and amorphous metals. The former method provides information on the electron density and/or capture centres (defects), whereas the latter method gives information on the electron momentum distribution through the material. The high-temperature superconductors were of the $YBa_2Cu_3O_{7-x}$ type, the amorphous metallic materials were of the $Fe_{80-x}Ni_xB_{20}$ type (x = 10, 20, 30, 40). The results demonstrate that for these kinds of materials the positron annihilation techniques can provide sufficient information on the behavior of electrons in the substances and also on some structural changes. (Z.S.). 2 refs.

20343 (INIS-mf–13192, pp. 67) **Strongly correlated fermions and high-T_C superconductivity.** Hudak, O. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The phase diagram of a material exhibiting high-temperature superconductivity is complex. The persisting problems are discussed of condensed systems which hinder the development of an adequate theoretical description of that diagram. These include the particularly insufficient insight into systems of fermions with a strong correlation and with a link to additional degrees of freedom. Among the simplest models describing such situations are Hubbard's model, the periodical Anderson's model and the t-J model. (Z.S.). 2 refs.

20344 (INIS-mf–13192, pp. 179-180) **Rare earths related phenomena in high-T_C superconductors.** Nekvasil, V. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Many compounds belonging to the new class of the perovskite-like copper oxides contain magnetic rare earth (RE) ions. The study of the crystal field, which splits the energy levels of 4f electrons of these ions and thus partially "quenches" their magnetic moments, is believed to help to monitor charge redistributions in the CuO_2 planes and thus to elucidate the nature of the high-T_C superconductivity in these materials. The results are presented of crystal field studies in $REBa_2Cu_3O_{7-x}$ and the Nd_2CuO_4-type compounds, where the charge carriers are holes and electrons, respectively. The relation between the crystal field and superconductivity is discussed. (Z.S.). 2 figs., 8 refs.

20345 (INIS-mf–13192, pp. 209-210) **Superconducting magnets for 200-400 MHz high-resolution NMR spectroscopy.** Jelinek, J. (Ceskoslovenska Akademie Ved, Brno (Czechoslovakia). Ustav Pristrovoje Techniky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Designs are described for the magnet of a 400 MHz spectrometer (induction 9.4 T), for which the fairly stable NbTi multifilamental superconductors (50 to 100 filaments in a Cu matrix) are still suited. The superconductor diameter in the sections is varied, e.g. from 0.5 to 0.8 mm, so that the current density should be adapted to the local field. A method of combining the multifilamental NbTi superconductors (junction resistance 10^{-11} to 10^{-14} ohm) was developed for attaining stability in time. Simultaneously with the 400 MHz magnet for a high resolution spectrometer, a 200 MHz magnet for NMR tomography, for in vivo spectrometry of small biological objects, etc., is being designed. (Z.S.). 2 figs.

20346 (IS-T–1580) **Neutron diffraction study of the electronic structure of high-$T_c$superconductor-related compounds.** Wang, Xun-Li. Ames Lab., IA (United States). 16 Mar 1992. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE92012587. Source: OSTI; NTIS; INIS; GPO Dep.

Neutron diffraction techniques have been used to study the electronic structure of La_2NiO_4 and $Sr_2CuO_2Cl_2$ by measuring the antiferromagnetic form factor of the single-crystal samples at 15 K. The antiferromagnetic form factor was obtained from the integrated intensities of several magnetic reflections. In both cases, the experimentally determined form factor exhibits a plateau at low Q values (up to 3 $Å^{-1}$), similar to that observed for La_2CuO_4. Detailed modeling of the experimental data of these three compounds suggests that the observed plateau may be accounted for by including the covalency effects in the Ni-O or Cu-O plane. The experimental data are also compared with spin-polarized band calculations.

20347 (ITF–90-54) **Theory of the fourth second in the relativistic system with the superfluidity.** Vil'chinskij, S.I.; Fomin, P.I. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1990. 12p. (In Russian). Order Number DE92627559. Source: OSTI; NTIS (US Sales Only); INIS.

The equations describing the propagation of the fourth sound in the relativistic theory of the superfluidity are derived. The expression for the velocity of the fourth sound is obtained. In the nonrelativistic limit it coincides with the corresponding expression in the theory of the superfluid helium. 7 refs.

20348 (ITP–89-28) **Interpretation of the T-H phase diagram of HTSC in the frame of superconductive granular layer model.** Burgij, A.I.; Shadura, V.N. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 20p. Order Number DE92627560. Source: OSTI; NTIS (US Sales Only); INIS.

The model of two-dimensional Coulomb gas on charge substrate is used to describe magnetic properties of high temperature superconductor LaBaCuO. The phase transition from the nonergodic superconducting state to the ergodic one is associated with the melting of Wigner's two-dimensional crystal into the liquid crystal-hexatic, and the phase transition from ergodic superconducting state to the normal one - with the melting of liquid crystal. The T_c(H) dependence calculated within these concepts is consistent with that observed in experiment. 22 refs.; 3 figs.

20349 (LA-UR–92-922) **Proceedings, phenomenology and applications of high temperature superconductors.** Bedell, K.S. Los Alamos National Lab., NM (United States). [1991]. 527p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9108140–: Phenomenology and applications of high temperature superconductivity, Los Alamos, NM (United States), 22-24 Aug 1991). Order Number DE92011133. Source: OSTI; NTIS; INIS; GPO Dep.

Phenomenology and Applications of High Temperature Superconductors, The Los Alamos Symposium: 1991, was sponsored by the Los Alamos National Laboratory, Center for Materials Science, the Advanced Studies Program on High Temperature Superconductivity Theory (ASP) and the Exploratory Research and Development Center. This is the second symposium in the series. High Temperature Superconductivity, The Los Alamos Symposium: 1989, also published by Addison Wesley, focused on the cutting-edge theoretical and experimental issues in high temperature superconductors. This symposium, with its focus on the phenomenology and applications of high temperature superconductors, gives a complementary review of the aspects of the field closely related to the impact of high temperature superconductors on technology. The objective of ASP is to advance the field on a broad front with no specific point of view by bringing a team of leading academic theorists into a joint effort with the theoretical and experimental scientists of a major DOE national laboratory. The ASP consisted of fellows led by Robert Schrieffer (UCSB and now FSU) joined by David Pines (University of illinois), Elihu Abrahams (Rutgers), Sebastian Doniach (Stanford), and Maurice Rice (ETH, Zurich) and theoretical and experimental staff of Los Alamos National Laboratory. This synergism of academic, laboratory, theoretical and experimental research produced a level of interaction and excitement that would not be possible otherwise. This publication and the previous one in the series are just examples of how this approach to advancing science can achieve significant contributions.

665420 Superfluidity

20350 (INIS-mf–13192, pp. 203-206) **Observation of effects analogous to the Josephson effect on the spin flow in ^{3}He.** Makroczyova, V. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Slovak). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Phenomena which are referred to as the Josephson effects include, among others, effects associated with mass flows in ^{3}He. Theoretical as well as experimental results supported the assumption that the Josephson effect can also take place on spin superfluid flows in superfluid ^{3}He. Some experiments aimed at observating the Josephson effect on spin flows are described. (Z.S.). 4 figs., 10 refs.

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Refer also to citation(s) 20427, 20428, 20440, 20451, 20454, 20455, 20456, 20461, 20462, 20464, 20468, 20489, 20490

20351 (BARC–1991/P/001) **Progress report: Plasma Physics Division (July 1985 to March 1990).** Venkatramani, N. (Bhabha Atomic Research Centre, Bombay (India). Laser and Plasma Technology Div.); Thakur, A.V.; Viswanadam, C. (comps.). Bhabha Atomic Research Centre, Bombay (India). 1991. 198p. Order Number DE92627438. Source: OSTI; NTIS (US Sales Only); INIS.

The report summarizes the research and development (R and D) activities carried out by Laser and Plasma Technology Division, Bhabha Atomic Research Centre, Bombay during the period July 1985 to March 1990. The R and D activites are reported under the headings: 1) Thermal Plasma, 2) Electron Beam Technology, and 3) Industrial Design Section. A list of scientific and technical staff working in the different sections of the Division is also given. (author).

20352 (CONF-9105202–, pp. 7, Paper 2) **Plasma turbulence calculations on supercomputers.** Carreras, B.A. (Oak Ridge National Lab., TN (United States)); Charlton, L.A.; Dominguez, N.; Drake, J.B.; Garcia, L.; Leboeuf, J.N.; Lee, D.K.; Lynch, V.E.; Sidikman, K. USDOE Office of Energy Research, Washington, DC

(United States). Scientific Computing Staff. [1991]. DOE Contract AC05-84OR21400. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Although the single-particle picture of magnetic confinement is helpful in understanding some basic physics of plasma confinement, it does not give a full description. Collective effects dominate plasma behavior. Any analysis of plasma confinement requires a self-consistent treatment of the particles and fields. The general picture is further complicated because the plasma, in general, is turbulent. The study of fluid turbulence is a rather complex field by itself. In addition to the difficulties of classical fluid turbulence, plasma turbulence studies face the problems caused by the induced magnetic turbulence, which couples field by itself. In addition to the difficulties of classical fluid turbulence, plasma turbulence studies face the problems caused by the induced magnetic turbulence, which couples back to the fluid. Since the fluid is not a perfect conductor, this turbulence can lead to changes in the topology of the magnetic field structure, causing the magnetic field lines to wander radially. Because the plasma fluid flows along field lines, they carry the particles with them, and this enhances the losses caused by collisions. The changes in topology are critical for the plasma confinement. The study of plasma turbulence and the concomitant transport is a challenging problem. Because of the importance of solving the plasma turbulence problem for controlled thermonuclear research, the high complexity of the problem, and the necessity of attacking the problem with supercomputers, the study of plasma turbulence in magnetic confinement devices is a Grand Challenge problem.

20353 (CONF-9105202–, pp. 10, Paper 10) **Particle modeling of plasmas computational plasma physics.** Dawson, J.M. (Univ. of California, Los Angeles (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Recently, through the development of supercomputers, a powerful new method for exploring plasmas has emerged; it is computer modeling of plasmas. Such modeling can duplicate many of the complex processes that go on in a plasma and allow scientists to understand what the important processes are. It helps scientists gain an intuition about this complex state of matter. It allows scientists and engineers to explore new ideas on how to use plasma before building costly experiments; it allows them to determine if they are on the right track. It can duplicate the operation of devices and thus reduce the need to build complex and expensive devices for research and development. This is an exciting new endeavor that is in its infancy, but which can play an important role in the scientific and technological competitiveness of the US. There are a wide range of plasma models that are in use. There are particle models, fluid models, hybrid particle fluid models. These can come in many forms, such as explicit models, implicit models, reduced dimensional models, electrostatic models, magnetostatic models, electromagnetic models, and almost an endless variety of other models. Here the author will only discuss particle models. He will give a few examples of the use of such models; these will be taken from work done by the Plasma Modeling Group at UCLA because he is most familiar with work. However, it only gives a small view of the wide range of work being done around the US, or for that matter around the world.

20354 (CONF-9105202–, pp. 6, Paper 13) **Fluid-particle hybrid simulation of tokamak plasmas.** Park, W. (Princeton Univ., NJ (United States)); Parker, S.; Lee, W.W.; Monticello, D.A. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. DOE Contract AC02-76CH03073. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Present-day tokamaks, such as TFTR at Princeton Univ., and JET in Europe, have produced hot plasmas (ionized gas) which are approaching the break-even condition. At the break-even condition, the heat input required would be equal to the fusion power output if deuterium-tritium plasmas were used instead of the currently used deuterium-only plasmas. Such deuterium-tritium TFTR experiments are currently planned for 1993. In these experiments, the energetic Alpha particles produced by fusion reactions will play an important role in determining the outcome of the plasma discharge. Alpha particle physics will become even more important in the proposed Burning Plasma Experiment (BPX). In the paper, the authors describe their method for the numerical simulation of the Alpha effects, namely the fluid-particle hybrid model where the Alpha particles are followed numerically as individual particles, while the background plasma is treated as fluid. They start by first describing the fluid model.

20355 (CONF-9105202–, pp. 8, Paper 15) **Fluid simulation of drift-resistive ballooning modes and the L-H transition in tokamaks.** Guzdar, P.N. (Univ. of Maryland, College Park (United States)); Drake, J.F.; Hassam, A.B.; McCarthy, D.; Liu, C.S. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Over the last decade one of the significant scientific findings in tokamak research is the existence of two modes of operation: the L (low confinement) and H (high confinement) modes. In L mode operation the introduction of auxiliary power raises the temperature (as expected) but at the same time degrades the energy confinement. However, as the auxiliary power increases beyond a critical level of the tokamak discharge makes an abrupt transition to the H mode. The confinement time is about 2 to 3 times better than in L mode discharges. The present design of ITER is based on L mode operation. Because of the low confinement, the size of the machine has to be appropriately scaled up. This readily translates into a scaled up budget for the program. This pessimistic L mode scenario is used in the design of ITER since there is no detailed understanding of the L-H transition. The estimated cost for ITER based on the H-mode operation is $1B compared to $5B for the L-Mode scenario. Thus the understanding of L-H transitions in magnetic fusion research is an important problem both from the scientific as well as economic point of view. In this study the authors made a modest first principles approach towards understanding the process of L-H transitions. The basic framework is the use of fluid equations to characterize the plasma in the edge region of tokamaks. These 3D fluid equations (Braginskii) are solved using a CRAY II at NERSC in Livermore, California.

20356 (CONF-9105202–, pp. 6, Paper 16) **Gyrokinetic particle simulation on massively parallel computers: A computational tokamak for fusion research.** Lee, W.W. (Princeton Univ., NJ (United States)); Parker, S.E.; Reynders, J.V.W.; Santoro, R.A. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

One of the most challenging problems in tokamak fusion research is the identification of the mechanism(s) responsible for the particle and heat loss across the confining magnetic field, known as anomalous transport. Although great strides have been made over the past forty years in understanding the behavior of magnetically-confined plasmas, the transport issue remains largely unresolved. With the recent advances in plasma modeling using particle simulation techniques and the availability of the massively parallel computers, the authors are now in a position to initiate a comprehensive study of this important problem. In doing so, they hope that a reliable scaling law will emerge, which can give them a better projection of the ignition margin for the future tokamaks, such as ITER (International Tokamak Engineering Reactor) and BPX (Burning Plasma Experiment), and, in turn, can bring fusion energy a step closer to reality.

20357 (CONF-9105202–, pp. 8, Paper 18) **Emerging computational techniques to predict confinement in fusion devices.** Kotschenreuther, M. (Univ. of Texas, Austin (United States)); Miner, W.H. USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Newly developed computational techniques are used to better quantitatively define a fundamental technical capability needed for controlled fusion energy: the degree to which a hot thermonuclear plasma can be contained by magnetic fields. First, the ramifications to the Magnetic Fusion Energy program of uncertainties in this basic technical element are indicated, to set the context for the importance of such calculations. Limitations of previous calculations to deduce confinement are noted, which are overcome by the new techniques used here. An application of these techniques shows that a particular instability mechanism which had been widely believed to control confinement is, to the contrary, of relatively minor importance. This demonstrates the importance of the greater accuracy and completeness offered by the new algorithm.

20358 (CONF-910711–9) **Electron transport in the stochastic fields of RFP ZT-40M.** Punjabi, A. (Hampton Univ., VA (United States)); Verma, A.; Kim, Myung-Hee; Boozer, A. Hampton Univ., VA (United States). [1991]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-90ER54106 ;FG05-88ER53265. From 20. international conference on phenomena in ionized gases; Barga (Italy); 8-12 Jul 1991. Order Number DE92013226. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we use our newly developed Monte Carlo Method to study the transport of electrons in stochastic magnetic fields of the device RFP ZT4OM. The results of this calculation will be compared with the Rechester-Rosenbluth scaling.

20359 (CONF-920311–2) **Effects of limiter biasing on the ATF torsatron.** Uckan, T. (Oak Ridge National Lab., TN (United States)); Baylor, L.R.; Bell, J.D.; Bigelow, T.S.; England, A.C.; Harris, J.H.; Isler, R.C.; Jernigan, T.C.; Lyon, J.F.; Ma, C.H.; Mioduszewski, P.K.; Murakami, M.; Rasmussen, D.A.; Wilgen, J.B.; Aceto, S.C.;.Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. international conference on plasma-surface interactions in controlled fusion devices; Monterey, CA (United States); 30 Mar - 3 apr 1992. Order Number DE92011782. Source: OSTI; NTIS; INIS; GPO Dep.

Positive limiter biasing on the currentless ATF torsatron produces a significant increase in the particle confinement with no improvement in the energy confinement. Experiments have been carried out in 1-T plasmas with ~400 kW of ECH. Two rail limiters located at the last closed flux surface (LCFS), one at the top and one at the bottom of the device, are biased at positive and negative potentials with respect to the vessel. When the limiters are positively biased at up to 300 V, the density increases sharply to the ECH cutoff value. At the same time, the H_α radiation drops, indicating that the particle confinement improves. When the density is kept constant, the H_α radiation is further reduced and there is almost no change of plasma stored energy. Under these conditions, the density profile becomes peaked and the electric field becomes outward- pointing outside the LCFS and more negative inside the LCFS. In contrast, negative biasing yields some reduction of the density and stored energy at constant gas feed, and the plasma potential profile remains the same. Biasing has almost no effect on the intrinsic impurity levels in the plasma.

20360 (CONF-920362–9) **Diagnostic needs for fluctuations and transport studies.** Carreras, B.A. Oak Ridge National Lab., TN (United States). [1992]. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. topical conference on high-temperature plasma diagnostics; Santa Fe, NM (United States); 15-19 Mar 1992. Order Number DE92011048. Source: OSTI; NTIS; INIS; GPO Dep.

The identification of fundamental transport mechanisms in magnetically confined plasmas is a critical issue for the magnetic fusion program. Recent progress in understanding fluctuations and transport is well correlated with the development and use of new diagnostics, but there a great deal of information is still missing. Some of the required measurements are well beyond our present diagnostic capabilities, but some are within reach and could answer critical questions in this area of research. Some of these critical issues are discussed.

20361 (CONF-920362–23) **Density profile measurement using a multichannel difluoromethane laser interferometer system on ATF.** Ma, C.H.; Baylor, L.R.; Hutchinson, D.P.; Murakami, M.; Wilgen, J.B. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. topical conference on high-temperature plasma diagnostics; Santa Fe, NM (United States); 15-19 Mar 1992. Order Number DE92011691. Source: OSTI; NTIS; INIS; GPO Dep.

Recent results of the electron density profile measurement on the Advanced Toroidal Facility (ATF) are presented. A multichannel difluoromethane laser interferometer system has been routinely employed to study density evolution in ECH as well as neutral-beam-heated plasma discharges with gas fueling and pellet injection. A chordal inversion code has been developed, and has been used successfully to reconstruct the asymmetric density profiles. Cross-correlation of density profiles measurements among FIR interferometer, Thomson scattering, the heavy-ion beam probe, and the fast reciprocating Langmuir probe has been achieved. Radial density profiles measured by the four diagnostics are generally in good agreement and are hollow profiles under most experimental conditions.

20362 (CTH-IEFT-PP–1991-23) **Stochastic nature of ICRF wave-particle interaction in tokamaks.** Helander, P.; Lisak, M. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 23p. Order Number DE92625097. Source: OSTI; NTIS (US Sales Only); INIS.

The threshold in wave amplitude for the onset of stochastic motion of ICRF heated minority ions in tokamaks is calculated. As a separate result, the solutions to the guiding centre equations of motion are presented. The effects of the finite orbit width of high energy particles and the ellipticity of the flux surfaces are fully taken into account. Because of drift motion, co-passing particle require weaker wave fields for stochastization than counter-passing ones. The orbits of trapped particles become even more easily stochastic, and near the trapped (passing boundary) an arbitrarily weak wave field is needed for orbit stochastization. Finite orbit width effect have significant impact on the results, decreasing the stochastization amplitude near the magnetic axis. For realistic JET parameters, only a small fraction of the minority ions move stochastically in a monochromatic IRCF wave field. (author).

20363 (DOE/ER/53214–2) **Spectroscopic diagnostics of high temperature plasmas: [Annual report].** Moos, W. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Physics and Astronomy. [1990]. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER53214. Order Number DE92013153. Source: OSTI; NTIS; INIS; GPO Dep.

A three-year research program for the development of novel XUV spectroscopic diagnostics for magnetically confined fusion plasmas is proposed. The new diagnostic system will use layered synthetic microstructures (LSM) coated, flat and curved surfaces as dispersive elements in spectrometers and narrow band XUV filter arrays. In the framework of the proposed program we will develop impurity monitors for poloidal and toroidal resolved measurements on PBX-M and Alcator C-Mod, imaging XUV spectrometers for electron density and temperature fluctuation measurements in the hot plasma core in TEXT or other similar tokamaks and plasma imaging devices in soft x-ray light for impurity behavior studies during RF heating on Phaedrus T and carbon pellet ablation in Alcator C-Mod. Recent results related to use of multilayer in XUV plasma spectroscopy are presented. We also discuss the latest results reviewed to q_o and local poloidal field measurements using Zeeman polarimetry.

20364 (DOE/ER/53214–T1) **Extreme ultraviolet and soft x-ray diagnostics of high-temperature plasmas: Progress report.** Moos, W. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Physics and Astronomy. 2 Oct 1986. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER53214. Order Number DE92013133. Source: OSTI; NTIS; GPO Dep.

This report describes recent progress and plans for calendar year 1987 in the Johns Hopkins University program to develop and improve spectroscopic diagnostics for the high temperature plasmas used in magnetic fusion research. An EUV spectrograph which provides time resolved spectra along fifteen chords of a plasma device has been completed and evaluation on DIII-D will began in late 1986. Other instrumentation work includes the evaluation of a sensitive detector for ion temperature/velocity distribution determinations and a feasibility study of Zeeman polarimetry for determining magnetic fields. A comprehensive data set taken on the TEXT tokamak is undergoing analysis as a means of improving the ionic parameters used in diagnostic studies and to expand the capabilities of existing instruments. Potential new advanced in spectroscopic technology are being monitored to determine if they provide advantages for fusion research.

20365 (DOE/ER/53250–3) **Non-local kinetic transport studies of a field-reversed configuration: Annual technical report, July 1, 1988–June 30, 1989.** Choi, Chan K. Purdue Univ., Lafayette, IN (United States). School of Nuclear Engineering. [1989]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER53250. Order Number DE92012376. Source: OSTI; NTIS; INIS; GPO Dep.

One of the positive results that came from the work in this period was the development of a series of codes for solving the 2-D equilibrium FRC problem under various basic physics assumptions. The derivation of the models used to determine an FRC equilibrium was presented in the previous annual report, which is to be submitted to Physics of Fluids. The derivation is not repeated in this section; rather, some examples of what has been learned using these codes are presented. To date, the codes have been useful in four essential areas. First, it was shown that passive mirrors present in the early operation of the LSM device were interacting strongly with the plasma. This caused the inference of some key quantities to be inaccurate. Second, profiles have been found that can exist in the plasma and could cause the present inference of the field null resistivity to be significantly in error. Third, it has become possible to examine rotational effects in the FRC equilibrium from the standpoint of modification of both equilibrium and stability properties. Fourth, it has made possible a realistic study of the MHD stability of the system.

20366 (DOE/ER/53250–5) **Non-local kinetic transport studies of a field reversed configuration: Annual technical report, July 1, 1989–June 30, 1990.** Choi, Chan K. Purdue Univ., Lafayette, IN (United States). School of Nuclear Engineering. [1990]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER53250. Order Number DE92012377. Source: OSTI; NTIS; INIS; GPO Dep.

During this past period a computer code was developed to determine the global kinetic linear stability for a 1-D Field-Reversed Configuration (FRC). This report will describe the physical assumptions used to model the plasma, the equations solved by the code, the numerical analysis for certain aspects of the code, and some preliminary results from the code.

20367 (DOE/ER/54131–1) **Non-geothermal optics study of wave propagation: Annual progress report, August 1991–March 1992.** Imre, K. College of Staten Island, NY (United States). Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER54131. Order Number DE92011806. Source: OSTI; NTIS; INIS; GPO Dep.

A statistical theory of growth curve analysis, which makes use of smoothing splines is formulated and coded for applications. We have tested our codes extensively using computer generated data superposed with random noise of various intensities, by simultaneously fitting all data with two independent variables. We are presently evaluating various experimental data in the MFE database by making use of our codes. Our preliminary results indicate that TFTR ohmic temperature profile shape depends almost exclusively on the edge plasma safety factor, q_a, as was previously shown to be true for ASDEX plasma profiles. The main advantage of the utilization of a simultaneous fitting of all (appropriately normalized) profiles as a function of more than one plasma parameter, is to improve significantly the signal to noise ratio. We also determine the amount of smoothing to be applied during the curve fitting process. An optimally selected smoothing helps to reduce the random noise, but yet allows the predictions to stay close to the data. In addition, the use of a multi-dimensional parameter field provides us with a uniformly valid representation. The curve fitting technique we employ uses a piecewise polynomial spline representation. However, we have eliminated the usually adopted method of setting a simple knot at every data point, for the reason that the experimentally obtained data is usually confined to the values of the plasma parameters bunched together in small intervals which are widely separated. Presently, we are using equally spaced knots.

20368 (DOE/ET/53088–530) **Nonlinear evolution of resistive tearing mode instability with shear flow and viscosity.** Ofman, L. (Texas Univ., Austin, TX (United States). Inst. for Fusion Studies); Morrison, P.J.; Steinolfson, R.S. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Dec 1991. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–530). Order Number DE92012138. Source: OSTI; NTIS; INIS; GPO Dep.

The nonlinear evolution of the tearing mode instability with equilibrium shear flow is investigated via numerical solutions of the resistive magnetohydrodynamic equations. The two-dimensional simulations are in slab geometry, are periodic in the x-direction, and are initiated with solutions of the linearized MHD equations. The magnetic Reynolds number S was varied from 10^2 to 10^5, a parameter V that measures the strength of the flow in units of the average Alfven speed was varied, and the viscosity as measured by the Reynolds number of S_v satisfied $S_v > 10^3$. When the shear flow is small ($V < 0.3$) the tearing mode saturates within one resistive time, while for larger flows the nonlinear saturation develops on a longer time scale. The two-dimensional spatial structure of both the flux function and the steam function distort in the direction of the equilibrium flow. The magnetic energy release decreased and the saturation time increased with V, for both small and large resistivity. The validity of the numerical solutions was tested by verifying that the total energy and the magnetic helicity were conserved. Total energy dissipation rate dE/dt decreases as the tearing mode approached its saturated state.

20369 (DOE/ET/53088–541) **Low-frequency fluctuations in plasma magnetic fields.** Cable, S.; Tajima, T. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Feb 1992. 84p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–541). Order Number DE92012139. Source: OSTI; NTIS; INIS; GPO Dep.

It is shown that even a non-magnetized plasma with temperature T sustains zero-frequency magnetic fluctuations in thermal equilibrium. Fluctuations in electric and magnetic fields, as well as in densities, are computed. Four cases are studied: a cold, gaseous, isotropic, non-magnetized plasma; a cold, gaseous plasma in a uniform magnetic field; a warm, gaseous plasma described by kinetic theory; and a degenerate electron plasma. For the simple gaseous plasma, the fluctuation strength of the magnetic field as a function of frequency and wavenumber is calculated with the aid of the fluctuation-dissipation theorem. This calculation is done for both collisional and collisionless plasmas. The magnetic field fluctuation spectrum of each plasma has a large zero-frequency peak. The peak is a Dirac δ-function in the collisionless plasma; it is broadened into a Lorentzian curve in the collisional plasma. The plasma causes a low frequency cutoff in the typical black-body radiation spectrum, and the energy under the discovered peak approximates the energy lost in this cutoff. When the imposed magnetic field is weak, the magnetic field were vector fluctuation spectra of the two lowest modes are independent of the strength of the imposed field. Further, these modes contain finite energy even when the imposed field is zero. It is the energy of these modes which forms the non-magnetized zero-frequency peak of the isotropic plasma. In deriving these results, a simple relationship between the dispersion relation and the fluctuation power spectrum of electromagnetic waves if found. The warm plasma is shown, by kinetic theory, to exhibit a zero-frequency peak in its magnetic field fluctuation spectrum as well. For the degenerate plasma, we find that electric field fluctuations and number density fluctuations vanish at zero frequency; however, the magnetic field power spectrum diverges at zero frequency.

20370 (ETDE-IT--92-20) **Power flux distribution on capsule enclosed in radiating cavity.** Dattoli, G.; Mari, C.; Mezi, L.; Torre, A. ENEA, Frascati (Italy). 1991. 12p. (CONF-910247-4: International conference on research trends in inertial confinement fusion, La Jolla, CA (United States), 4-9 Feb 1991). Order Number DE92506284. Source: OSTI; NTIS (US Sales Only); INIS.

Within the framework of studies on inertial confinement fusion, this paper examined how non-uniformities in the distribution of the radiation sources on the surface of a radiating cavity are reduced by geometrical averaging, i.e., by the fact that a given point upon a spherical capsule, enclosed within, 'sees' an extended cavity area. It was evaluated how this reduction depends on the relative cavity/capsule size and on the non-uniformity wavelength. With regard to the emitter, two cases were considered, that of an optically thick emitting layer, and that of an optically thin one, according to two angular distributions (the frequency label is neglected) in which the specific intensity upon the cavity was assumed to have cylindrical symmetry.

20371 (ETDE-IT--92-30) **Effect of poloidal field null on alpha-particle orbits in axisymmetric tokamaks.** Batistoni, P.; Segre, S.E. ENEA, Frascati (Italy). 1991. 17p. (CONF-9106209-5: International Atomic Energy Agency (IAEA) technical committee meeting on alpha particles in fusion, Aspenas (Sweden), 10-14 Jun 1991). Order Number DE92506246. Source: OSTI; NTIS (US Sales Only).

The effect of a poloidal magnetic field null (X-point region) on the orbits of energetic fusion products is analysed. It is found that the resulting poloidal distribution of lost particles is strongly peaked in the vicinity of the X-point, for an axisymmetric magnetic field distribution. This effect should be considered, together with the effect of field ripple, in the analysis of energetic particle diagnostics and of loading of wall structures.

20372 (ETDE-IT--92-31) **Alpha particle confinement and loss distribution in stellarators as function of aspect ratio.** Alladio, F.; Batistoni, P.; Mancuso, A. ENEA, Frascati (Italy). 1991. 24p. (CONF-9106209-6: International Atomic Energy Agency (IAEA) technical committee meeting on alpha particles in fusion, Aspenas (Sweden), 10-14 Jun 1991). Order Number DE92506247. Source: OSTI; NTIS (US Sales Only).

The properties of alpha particle confinement of $m = 2$ stellarators have been studied as a function of the aspect ratio. A collisionless orbit calculation has been performed numerically for stellarator configurations obtained winding the helicoidal currents on circular cross section tori with constant pitch in toroidal coordinates. All the studied configurations exhibit pronounced- separatrix like features that also rotate with constant pitch in toroidal coordinates. The fraction of alpha particles contained within the last closed magnetic surface rapidly increases with the aspect ratio and is higher than 80% for $R/a>4$. The escaping alpha particles cross the separatrix within narrow helical strips around the X-point path when it is between the inboard and the upboard of the torus. The particle motion is also followed outside the closed magnetic surface. When the boundary (i.e. the surface where the helicoidal currents flow) is sufficiently far from the plasma, the escaping alpha particles are found to remain trapped in the X-point region.

20373 (FRCEA-TH-353) **Energy recovery in high energy neutral beam injectors.** Laffite, S. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee; Aix-Marseille-1 Univ., 13 - Marseille (France). Jul 1991. 262p. (In French). Order Number DE92517880. Source: OSTI; NTIS (US Sales Only); INIS.

One way to heat the plasma of thermonuclear fusion experiments, is to inject high energy (50 to 100 KeV per nucleon), neutral particles (hydrogen or deuterium). Neutral beam elaboration consists in ion production and acceleration, neutralisation by charge exchange on gas target, disposal of unneutralized ions. But, in the case of positive ion based neutral beam injection, the neutralisation efficiency is limited to 50% at 100 KeV, and decreases rapidly with energy. The energy recovery is a new method for disposing of the unneutralized ions: these are electrostatically decelerated and collected on electrodes which are polarized at low voltage, close to the ion source potential. An energy recovery system was studied and experimented with positive ion beams of 50 and 100 KeV. In the framework of a french-japanese collaboration, we measured a relative power reduction of about 20%, with 100 KeV, 1,5 MW deuterium beams. We have also studied theoretically an energy recovery system for negative ion beams, which will be utilized at high energy (1 MeV). A relative power reduction of 20% can be expected in the best conditions.

20374 (GA-A--20849) **Design and operation of the multi-pulse Thomson scattering diagnostic on DIII-D.** Carlstrom, T.N. (General Atomics, San Diego, CA (United States)); Campbell, G.L.; DeBoo, J.C.; Evanko, R.; Greenfield, C.M.; Haskovec, J.; Hsieh, C.L.; McKee, E.; Snider, R.T.; Stockdale, R.; Trost, P.K.; Thomas, M.P.; Evans, J. General Atomics, San Diego, CA (United States). Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920362-21: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011393. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the design and operation of a 40 spatial channel Thomson scattering system that uses multiple 20 Hz Nd:YAG lasers to measure the electron temperature and density profiles periodically throughout an entire plasma discharge. As many as eight lasers may be fired alternately for an average measurement frequency of 160 Hz, or they may be fired in rapid succession (< 10 kHz), producing a burst of pulses for measuring transient events. The high spatial resolution (1.3 cm) and wide dynamic range (10 eV to 20 keV) enable this system to resolve large electron density and temperature gradients formed at the plasma edge and in the scrape-off-layer during H-mode operation. These features provide a formidable tool for studying L-H transitions, edge localized modes (ELMs), beta limits, transport, and disruptions in an efficient manner suitable for large tokamak operation where shot-to-shot scans are impractical. The scattered light is dispersed by interference filter polychromators and detected by silicon avalanche photodiodes. Laser control and data acquisition are performed in real-time by a VME based microcomputer. Data analysis is performed by a MicroVAX 3400. Additional features of this system include real-time analysis capability, full statistical treatment of error bars based on the measured background light, and laser beam quality and alignment monitoring during plasma operation. Results of component testing, calibration, plasma operation, and error analysis are presented.

20375 (GA-A--20855) **Short wavelength interferometer for ITER.** Snider, R.T.; Carlstrom, T.N. General Atomics, San Diego, CA (United States). Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920362-25: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92013008. Source: OSTI; NTIS; INIS; GPO Dep.

There is a need for a real time, reliable density measurement compatible with the restricted access and radiation environment on ITER. Due to the large plasma path length, high density and field, refraction and Faraday rotation effects makes the use of contemporary long wavelength ($>50\mu m$) interferometers impractical. In this paper we consider the design of a short wavelength vibration compensated interferometer which allows operation without a prohibitively large vibration isolated structure and permits the optics to be conveniently mounted directly in or on the tokamak. A density interferometer design for ITER incorporating a 10.6 μm CO_2 interferometer with vibration compensation provided by a 3. 39 μm HeNe laser is discussed. The proposed interferometer design requires only a small intrusion into the ITER tokamak without a large support structure, refraction and Faraday rotation problems are avoided, and it provides a density resolution of at least 0.5%. Results are presented from an interferometer installed on the DIII-D tokamak incorporating essential elements of the proposed ITER design including 10.6 and 3.39 μm lasers, a retro-reflector mounted on the vacuum wall of the DIII-D tokamak and real-time density feedback control. In this paper we consider a short wavelength interferometer design that incorporates vibration compensation for use on ITER. Our primary concern is to develop a interferometer design that will produce a reliable real time density monitor. We use the ITER conceptual design activity report as the basis of the design.

20376 (GA-A–20876) **A phase contrast interferometer on DIII-D.** Coda, S. (Massachusetts Inst. of Tech., Cambridge, MA (United States)); Porkolab, M.; Carlstrom, T.N. General Atomics, San Diego, CA (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920362–24: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92012699. Source: OSTI; NTIS; INIS; GPO Dep.

A novel imaging diagnostic has recently become operational on the DIII-D tokamak for the study of density fluctuations at the outer edge of the plasma. The phase contrast imaging approach overcomes the limitations of conventional scattering techniques in the spectral range of interest for transport-related phenomena, by allowing detection of long wavelength modes (up to 7.6 cm) with excellent spatial resolution (5 mm) in the radial direction. Additional motivation for the diagnostic is provided by wave-plasma interactions during heating and current drive experiments in the Ion Cyclotron range of frequencies. Density perturbations of 4×10^7 cm^{-3} with a 1 MHz bandwidth can be resolved. The diagnostic employs a 7.6 cm diameter CO_2 laser beam launched vertically across the plasma edge. An image of the plasma is then created on a 16-element detector array: the detector signals are directly proportional to the density fluctuations integrated along each chord. Wavelengths and correlation lengths can be inferred from the spatial mapping. The phase contrast method and its application to DIII-D are described and tests and first plasma data are presented.

20377 (INIS-mf–13178, pp. 97-120) **Update on the international status of cold fusion.** Srinivasan, M. (Bhabha Atomic Research Centre, Bombay (India). Neutron Physics Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991. 269p. (CONF-9101139–: Solid state physics symposium, Bombay (India), 1-4 Jan 1991). In *Proceedings of the solid state physics symposium: Combined Vol. 32A and Vol. 33A: Invited talks.* Order Number DE92001361. Source: OSTI; NTIS (US Sales Only); INIS.

A broad overview of the cold fusion scene as it stands by the end of December 1990 is presented. It covers: (1) calorimetry/excess heat studies in D_2O electrolysis, (2) molten salt electrolysis experiment, (3) evidence for neutrons and tritium in electrolysis experiments, (4) 4 to 6 MeV energy neutron component in electrolysis, (5) charged particles and X-rays in electrolysis experiments, (6) neutron emission and charged particles from gas loaded Ti, (7) charged particles from ion-beam loaded Ti, (8) precursor to charged particle emission from gas loaded Pd, (9) solid state cell experiments and (10) neutron production in a Pd surface barrier plate. (M.G.B.). 60 refs., 8 figs., 2 tabs.

20378 (INIS-mf–13192, pp. 195-196) **Interaction of lower hybrid waves with thermonuclear alpha particles in tokamak reactor.** Krlin, L. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Pavlo, P.; Klima, R. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

A brief quantitative evaluation is presented of the absorption of the lower hybrid wave on the resonance with high overtones of the cyclotron motion in the ITER tokamak, which is an international tokamak reactor project. Fusion of tritium and deuterium nuclei producing 3.5 MeV alpha particles should take place in the tokamak reactor. The cyclotron motion radius for these particles in the tokamak's magnetic field ($\approx$ 5T) is substantially higher than the wavelength of the lower hybrid wave, and this is what makes possible absorption of that wave on the resonance $\omega = n\omega_c$ (ω is the frequency of the wave and ω_c is the cyclotron frequency of the alpha particles; $n >> 1$). The resonance is unwanted because it withdraws energy of waves destined for electrons forming the toroidal electric current. Theory demonstrates that the absorption of lower hybrid waves by alpha particles drops rapidly if their frequency is increased to above a critical value f_k. This value depends on the plasma density, magnetic field intensity and alpha particle energy. The results of computer modeling of the effect of alpha particles on the current generation by lower hybrid waves are described. A quite new finding concerned the existence of accelerated particles with an energy exceeding 10 MeV, which contribute substantially to the unwanted absorption of waves. The ratios of powers absorbed on alpha particles and on electrons were also determined for the ITER project. At a frequency of 4 GHz the ratio is about 10%, whereas at frequencies $\geq$ 5 GHz it is negligible. (Z.S.). 3 figs., 4 refs.

20379 (INIS-mf–13192, pp. 113-116) **Simulation of laser-matter interaction in subpicosecond range using computer algebra for numerical code development.** Drska, L. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska); Limpouch, J.; Liska, R. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The interaction of extremely short laser pulses with plasma is studied using numerical simulation. The FIDE package is briefly described, used for semiautomatic development and analysis of the simulation code. The physical model and the results of simulation of the interaction of a 1 ps laser pulse with an Al plasma are presented. The processes of laser absorption and heat flux limitations are discussed. (author). 3 figs., 12 refs.

20380 (INIS-mf–13192, pp. 197-198) **Plasma experiments with iodine laser system PERUN.** Chvojka, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Kralikova, B.; Krasa, J.; Laska, L.; Masek, K.; Rohlena, K.; Rus, B.; Skala, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (In Czech). (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists.* Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

The iodine photodissociation laser system PERUN was used for the generation of laser plasma. Three types of aluminium targets were employed. The laser pulse duration was 300 to 600 ps and contrast was better than 10^6. The power density at the target was to exceed $10^{13}/cm^2$, a value sufficient for the formation of hot laser plasma. The most important property of hot laser plasma is its ability to emit soft X-rays over the 0.1-10 nm range. The interaction chamber was therefore fitted with X-ray diagnostic equipment. Two crystal spectrometers were employed for spectral analysis of the emerging X-rays (particularly in the region of the line spectrum), and a pair of Be foils, acting as filters and also equipped with a pair of Si PIN diodes for recording, served to measure the temperature in the continuous spectral region. The time behavior of the emission could be examined in the visible region only, using a Hamamatsu streak camera. The observed plasma temperature was $(0.4\text{-}1.6)\times 10^{20}$ cm^{-3}, in dependence on the incident energy. (Z.S.). 3 refs.

20381 (INIS-mf–13192, pp. 253) **Compact spectrometer for laser plasma diagnostics.** Renner, O. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Fyzikalni Ustav); Krousky, E.; Pina, L. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague

(Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PLASMA DIAGNOSTICS/x-ray spectrometers; LASER-PRODUCED PLASMA

20382 (INIS-mf–13192, pp. 253) **Characteristics of water stabilised plasma generators.** Dudas, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1991. 319p. (CONF-9008243–: 10. conference of Czechoslovak physicists, Brno (Czechoslovakia), 27-31 Aug 1990). In *The tenth conference of Czechoslovak physicists*. Order Number DE92628439. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PLASMA PRODUCTION/spectroscopy; PLASMA DIAGNOSTICS; SPECTROSCOPY

20383 (IPP–5/37) **Unfolding of bolometer signals at the tokamak ASDEX Upgrade (case 1: On flux surfaces of constant emissivity).** Wunderlich, R.; Schneider, W.; Lackner, K. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Jan 1992. 30p. (In German). Order Number DE92516984. Source: OSTI; NTIS (US Sales Only); INIS.

We describe an algorithm and present a FORTRAN programme which allow to derive the distribution of the radiation emission from measured bolometer signals using flux surface structures computed by an equilibrium code. The algorithm assumes the emissivity to be constant on flux surfaces. Test examples are given and the use of the programme for ASDEX-Upgrade is described. Making a proper redefinition of the quantities, the programme can also be applied to the interpretation of measurements of line densities and X-ray emission. (orig.).

20384 (IPP–6/304) **Magnetic reconnection.** Biskamp, D.; Welter, H. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Oct 1991. 71p. Order Number DE92516509. Source: OSTI; NTIS (US Sales Only); INIS.

A review is given of the theory of magnetic reconnection in the framework of resistive magnetohydrodynamics (MHD). While most of the material refers to two-dimensional systems, the final sections give a brief outlook of problems arising in fully three-dimensional configurations. (orig.).

20385 (ITF–89-58) **Emission from inhomogeneous plasma layer.** Zagorodnij, A.G.; Korchinskij, G.M.; Yakimenko, I.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 29p. (In Russian). Order Number DE92627439. Source: OSTI; NTIS (US Sales Only); INIS.

General relations for the radiation spectra of a plasma layer with inhomogeneous parameter distributions are obtained. A detailed numerical analysis of the spectra under consideration for different inhomogeneity profiles are performed. 8 refs.; 15 figs.

20386 (ITF–89-82) **Surface waves in half-space and inhomogeneous plasma layer.** Zagorodnij, A.G.; Korchinskij, G.M.; Yakimenko, I.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 28p. (In Russian). Order Number DE92627455. Source: OSTI; NTIS (US Sales Only); INIS.

Within the framework of the hydrodynamic approach taking into account the electron pressure the dispersion relations for surface excitations in inhomogeneous plasma half-space and plasma layer are obtained. The numerical analysis of these relations is performed and on its basis the influence of plasma inhomogeneity on the dispersion and wave decrements is established. 18 refs.; 6 figs.

20387 (ITP–89-32) **Stationary spectra of short-wave low-frequency fluctuations in a finite-β plasma.** Sosenko, P.P.; Vakulenko, M.O. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 7p. Order Number DE92627456. Source: OSTI; NTIS (US Sales Only); INIS.

Stationary spectra of strongly nonlinear potential and magnetic fluctuations in a finite-β plasma, are calculated. Magnetic fluctuations are shown to produce an essential influence on the potential spectra. 7 refs.

20388 (ITP–89-37) **Low-frequency turbulence in an inhomogeneous magnetized plasma.** Sitenko, A.G.; Sosenko, P.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 9p. Order Number DE92627457. Source: OSTI; NTIS (US Sales Only); INIS.

The basic properties of low-frequency weak turbulence in magnetoactive plasma are discussed. It is noted that convective waves propagate in the ion diamagnetic drift direction. 11 refs.

20389 (ITP–89-38) **Electromagnetic effects in convective cells turbulence.** Sitenko, A.G.; Sosenko, P.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 12p. Order Number DE92627458. Source: OSTI; NTIS (US Sales Only); INIS.

The main aspects of the statistical theory of low-frequency hydrodynamic fluctuations in a magnetized plasma are reviewed. It is shown that magnetic field fluctuations may influence essentially the potential fluctuation spectral characteristics, which determine the level of anomalous plasma transport. 15 refs.

20390 (ITP–89-59) **Electrodynamic properties of inhomogeneous magnetoactive plasma: low-frequency limit.** Sitenko, A.G.; Sosenko, P.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 52p. Order Number DE92627459. Source: OSTI; NTIS (US Sales Only); INIS.

Low-frequency nonlinear electrodynamic properties of an inhomogeneous magnetoactive plasma are considered. Nonlinear convective and drift waves in plasma are studied as well. Plasma motion in crossed magnetic and gravitational fields and generation of magnetic fields in plasma are investigated. 68 refs.

20391 (ITP–89-60) **Parametric influence of powerful radiation on plasma surface.** Kuklin, V.M.; Panchenko, I.P.; Chernousenko, V.M. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 28p. Order Number DE92627460. Source: OSTI; NTIS (US Sales Only); INIS.

A self-consistent set of equations that describes one-dimensional dynamics to develop the instability of long-wave intensive Langmuir wave is obtained and solved. The parametric instability influence on the character of absorption of the incident radiation energy is elucidated primarily. 40 refs.; 8 figs.

20392 (ITP–89-66) **Nonlinear electromagnetic fluctuations in plasmas (renormalization concept).** Sitenko, A.G.; Sosenko, P.P. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1989. 36p. Order Number DE92627461. Source: OSTI; NTIS (US Sales Only); INIS.

The basic aspects of the renormalized statistical plasma electrodynamics are discussed. 44 refs.

20393 (ITP–91-25) **On the temperature role in the tunneling process at the cold fusion.** Grinyuk, B.E.; Simenog, I.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki. 1991. 12p. Order Number DE92627497. Source: OSTI; NTIS (US Sales Only); INIS.

The temperature dependence of the hydrogen isotopes cold fusion tunneling rate is estimated using a model of screened Coulomb interaction potential between the isotopes. The temperature dependences for the logarithm of the tunneling rate are calculated for pp-, pd-, pt- and dd-processes at different screening radii. Probable role of pp-reactions is discussed. 5 refs.; 4 figs.

20394 (JAERI-M–91-205) **Intermittent electric field in a random medium: A conjecture to cold fusion.** Tanaka, Masatoshi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Dec 1991. 14p. (In Japanese). Order Number DE92514959. Source: OSTI; NTIS (US Sales Only); INIS.

Possible existence of an intermittent electric field in a medium, in which the electric conductivity is supposed to be a random quantity, is studied on the basis of a model equation. Implication to cold fusion is noted. (author).

20395 (JET-R–91-10) **The calculation of the neoclassical impurity transport coefficients.** Lauro Taroni, L. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking); Giannella, R.; Springmann, E.; Taroni, A.; Bittoni, E. Commission of the European Communities, Abingdon (UK). JET

Joint Undertaking. Oct 1991. 25p. Order Number DE92628700. Source: OSTI; NTIS (US Sales Only); INIS.

The analysis of impurity transport in recent years has revived interest for the neoclassical predictions against which the experimental data are compared. Here we will attempt to sketch the hierarchy in the numerous formulae of previous authors expanding (for the Pfirsch-Schluter coefficients) highlighting the conditions under which they reduce to the analytical approximations found in the literature. The full set of transport coefficients described in the following article has been implemented in a computer package and examples of results will be given. (author).

20396 (JET-R--91-12) **Charge-exchange diagnostic of fusion alpha particles and ICRF driven minority ions in MeV energy range in JET plasma.** Izvozchikov, A.B. (Ioffe Physical-Technical Inst., St. Petersburg (USSR)); Khudoleev, A.V.; Petrov, M.P.; Petrov, S.Ya.; Kozlovskij, S.S.; Corti, S.; Gondahalekar, A. Commission of the European Communities, Abingdon (UK). JET Joint Undertaking. Dec 1991. 41p. Order Number DE92628699. Source: OSTI; NTIS (US Sales Only); INIS.

An important concern in alpha particle heating physics is that fusion alpha particles will be lost before giving all their energy to heat the plasma. In other words, that the radial diffusion time of the alphas may be shorter than their slowing down time in the plasma core. Therefore radially resolved measurements of density and energy spectrum of slowing-down alphas confined in the plasma are high priority diagnostic objectives. In this report application of Charge Exchange Neutral Particle Analysis on Joint European Torus will be discussed. After a description of physical principles of the method a suitable Neutral Particle Analyzer (NPA) will be described in detail and estimates of measurement performance made for different plasma heating and confinement modes in JET. (author).

20397 (JET-R--91-14) **Neutral beam-plasma interaction in JET: comparison of PENCIL and TRANSP modelling results.** Corrigan, G.; Muir, D.G.; Tibone, F. Commission of the European Communities, Abingdon (UK). JET Joint Undertaking. Jan 1992. 76p. Order Number DE92628701. Source: OSTI; NTIS (US Sales Only); INIS.

Using the TRANSP code as a reference, the accuracy of predictions by the simpler and much faster PENCIL code has been checked in several Joint European Torus (JET) plasma regimes. For sufficiently dense plasmas ($<n_e>$ "approx." $1.5 \cdot 10^{19}$ m^{-3}) and far enough away from large steps in the input power ($t >$ "approx." $t_{STEP} + 0.5$ sec) global and local predictions by PENCIL and TRANSP are found to be in excellent agreement. PENCIL can thus be confidently used as a fast and inexpensive computational tool for most transport studies of neutral beam injection (NBI) heated plasmas in JET. On the other hand, PENCIL results should not be trusted in strongly transient conditions (such as the early phase of a high-power NBI heating pulse) and in very low density regimes (when losses via charge-exchange processes can be a significant fraction of the input power). In these situations, TRANSP has to be used to obtain reliable results. We also briefly discuss the sensitivity of PENCIL results to the uncertainties associated with the JET experimental data used as input. As a by-product of these comparisons, we investigate the uncertainties inherent in the simulation of D-D neutron yields in high-performance JET discharges such as those used for the Preliminary Tritium Experiment. It is shown that - given the margins of error on the measured plasma profiles - the thermal neutron rate (typically half of the total in the hot-ion H-mode regime) cannot be simulated by either PENCIL or TRANSP with an accuracy better than ± 40%. Further uncertainty arises from the choice of nuclear cross-sections and flux surface geometry. (author).

20398 (KIYaI--90-22) **Investigation of possibilities of light nuclear cold fusion.** Dryapachenko, I.P.; Kononov, A.V.; Muravitskij, A.V.; Razbudej, V.F.; Saltykov, L.S.; Starchik, P.D.; Slobodyan, V.M. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 12p. (In Russian). Order Number DE92627498. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments for the finding of the cold nuclear fusion are described. Investigations have been performed for the Pd samples using different methods of the infusion of deuterium into metal. The different methods of the registration of n, p, γ -emission, T and ^{3}He have been used for the finding of the acts of the deuteron-deuteron fusion. Shock waves generated by an exploding conductors have been applied to the samples. 5 refs.; 6 figs.

20399 (LA-UR--92-826) **Intense diagnostic neutral beam development for ITER.** Rej, D.J. (Oak Ridge National Lab., TN (United States)); Henins, I.; Fonck, R.J.; Kim, Y.J. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362--16: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011262. Source: OSTI; NTIS; INIS; GPO Dep.

For the next-generation, burning tokamak plasmas such as ITER, diagnostic neutral beams and beam spectroscopy will continue to be used to determine a variety of plasma parameters such as ion temperature, rotation, fluctuations, impurity content, current density profile, and confined alpha particle density and energy distribution. Present-day low-current, long-pulse beam technology will be unable to provide the required signal intensities because of higher beam attenuation and background bremsstrahlung radiation in these larger, higher-density plasmas. To address this problem, we are developing a short-pulse, intense diagnostic neutral beam. Protons or deuterons are accelerated using magnetic-insulated ion-diode technology, and neutralized in a transient gas cell. A prototype 25-kA, 100-kV, 1-μs accelerator is under construction at Los Alamos. Initial experiments will focus on ITER-related issues of beam energy distribution, current density, pulse length, divergence, propagation, impurity content, reproducibility, and maintenance.

20400 (LA-UR--92-837) **PROPX: An X-ray Manipulation Program.** Kyrala, G.A. Los Alamos National Lab., NM (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362--15: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011264. Source: OSTI; NTIS; GPO Dep.

An interactive micro-computer program that performs some manipulations on an input x-ray spectrum is introduced and described. The program is used to calculate the effect of absorption of filters, transmission through fibers, responsivity of photocathodes, responsivity of absorptive detectors, folding of responses, plotting of cross sections, and calculation, as a function of electron temperature, of the response due to a bremsstrahlung spectrum. Fluorescence from the targets is not included. Two different x-ray libraries are offered, one covers the x-ray range 30--10,000 eV with 288 energy points, and the other covers the energy range 10 eV to 1 MeV with 250 energy points per decade. 7 refs.

20401 (LA-UR--92-903) **Calibration of scintillation detectors for MeV charged fusion products.** Tuszewski, M. (Los Alamos National Lab., NM (United States)); Zweben, S.J. Los Alamos National Lab., NM (United States). [1991]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362--17: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011135. Source: OSTI; NTIS; INIS; GPO Dep.

The light output of ZnS scintillators used to detect escaping fusion products in the TFTR Tokamak is studied with 3.5 MeV alpha and 3 MeV proton beams. The emitted light first increases linearly with beam current and then saturates. In all cases investigated, the onset of the saturation corresponds to a power of about 1 mW absorbed within the ZnS powder. The scintillators have adequate time response up to 50--100 kHz.

20402 (LA-UR--92-1043) **Optical diagnostics on dense Z-pinch plasmas.** Riley, R.A. Jr.; Lovberg, R.H.; Shlachter, J.S.; Scudder, D.W. Los Alamos National Lab., NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362--18: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011228. Source: OSTI; NTIS; INIS; GPO Dep.

A novel "point-diffraction" interferometer has been implemented on the Los Alamos Solid Fiber Z-Pinch experiment. The laser beam is split into two legs after passing through the plasma. The reference leg is filtered with a pin-hole aperture and recombined with the other leg to form an interferogram. This allows compact mounting of the optics and relative ease of alignment. The Z-Pinch experiment employs a pulsed-power generator that delivers up to 700 KA with a 100ns rise-time through a fiber of deuterium or deuterated polyethylene (CD_n) that is 5-cm long and initially solid with radius $r \approx 15 \mu m$. The interferometer, using a $\Delta t \approx 200$ps pulse from a Nd:YAG laser frequency doubled to $\lambda = 532$nm, measures the electron line density and, assuming azimuthal symmetry, the density as a function of radial and axial position. Calculations predict Faraday rotations of order $\pi/2$ for plasma and current densities that this experiment was designed to produce. The resulting periodic loss of fringes would provide the current density distribution.

20403 (LRP–439/91) **Plasma rotation and radial electric field with a density ramp in an ohmically heated tokamak.** Duval, B.P. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Joye, B.; Marchal, B. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Oct 1991. 21p. Order Number DE92627440. Source: OSTI; NTIS (US Sales Only); INIS.

Measurements of toroidal and poloidal rotation of the TCA plasma with Alfven Wave Heating and different levels of gas feed are reported. The temporal evolution of the rotation was inferred from intrinsic spectral lines of CV, CIII and, using injected helium gas, from HeII. The light collection optics and line intensity permitted the evolution of the plasma rotation to be measured with a time resolution of 2ms. The rotation velocities were used to deduce the radial electric field. With Alfven heating there was no observable change of this electric field that could have been responsible for the density rise which is characteristic of the RF experiments on TCA. The behaviour of the plasma rotation with different plasma density ramp rates was investigated. The toroidal rotation was observed to decrease with increasing plasma density. The poloidal rotation was observed to follow the value of the plasma density. With hard gas puffing, changes in the deduced radial electric field were found to coincide with changes in the peaking of the plasma density profile. Finally, with frozen pellet injection, the expected increase in the radial electric field due to the increased plasma density was not observed, which may explain the poorer confinement of the injected particles. Even in an ohmically heated tokamak, the measurement of the plasma rotation and the radial electric field are shown to be strongly related to the confinement. A thorough statistical analysis of the systematic errors is presented and a new and significant source of uncertainty in the experimental technique is identified. (author) 18 figs., 18 refs.

20404 (LRP–442/91) **Study of a cylindrical cavity gyrotron, influence of power reflection and of the oscillation of a travelling mode.** Muggli, P. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)). Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Nov 1991. 177p. (In French). Order Number DE92627501. Source: OSTI; NTIS (US Sales Only); INIS.

The quality factor and oscillating mode of a gyrotron cavity are essential parameters to consider when trying to obtain a high power (>500 kW), high efficiency (≈50%) microwave source, which oscillates in a stable manner in the principal mode of the cavity. The study and development of an 8 GHz gyrotron whose resonant cavity is formed by a cylindrical waveguide of slowly varying radius, is undertaken. The study is principally concerned with the phenomena associated with the low quality factor of the TE^{o}_{011} mode of the cavity. (author) figs., tabs., 102 refs.

20405 (LRP–444/91) **Cross-field diffusion quenching by neutral gas injection in a magnetized plasma.** Fasoli, A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Skiff, F.; Good, T.N.; Paris, P.J. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Dec 1991. 18p. Order Number DE92627449. Source: OSTI; NTIS (US Sales Only); INIS.

Cross-field transport of test ions is investigated in a linear Q-machine plasma. Test particles are created and followed in their motion by an optical tagging diagnostic scheme. Direct information on ion diffusivity is obtained from a comparison between the actual tag signal and a simple theoretical simulation. Diffusion is demonstrated to be supported by classical mechanisms. When different noble buffer gases are injected, the plasma reacts in such a way that the diffusivity remains classical but its magnitude is considerably reduced. (author) 9 figs., 15 refs.

20406 (LRP–450/92) **A measurement of hydrogen transport in deuterium discharges using the dynamic response of the effective mass.** Dudok de Wit, T. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Duval, B.P.; Joye, B.; Lister, J.B. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Feb 1992. 10p. Order Number DE92627450. Source: OSTI; NTIS (US Sales Only); INIS.

Particle tagging in a tokamak provides an attractive method for studying transport mechanisms. The injection of test particles at the plasma edge and the subsequent measurement of the evolution of their concentration at the centre can be used to quantify the underlying transport mechanisms. This has been carried out on the TCA tokamak by injecting hydrogen into a deuterium discharge, and simultaneously measuring the temporal evolution of the effective mass and the edge ionisation rate. (author) 3 figs., 9 refs.

20407 (LRP–451/92) **The dynamical response of the plasma as a tool for investigating transport mechanisms.** Moret, J.M. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Dudok de Wit, T.; Joye, B.; Lister, J.B. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Feb 1992. 39p. Order Number DE92627451. Source: OSTI; NTIS (US Sales Only); INIS.

The dynamical response of the soft X-ray emission profile to different external perturbations - gas feed, impurity injection, RF power, surface loop voltage - has been studied on the TCA tokamak and analysed using the same techniques. The frequency dependence of the response has been exploited to distinguish between the dominant transport processes. Remarkably similar phase response profiles were obtained with the different stimuli; they show a link with the sawtooth activity. The model which most plausibly explains these experimental observations requires diffusive transport with the diffusive coefficient locally modulated by the perturbation. (author) 15 figs., 27 refs.

20408 (NIFS–123) **Relaxed state of energy in incompressible fluid and incompressible MHD fluid.** Kondoh, Yoshiomi (Gunma Univ., Kiryu (Japan). Faculty of Technology). National Inst. for Fusion Science, Nagoya (Japan). Dec 1991. 16p. Order Number DE92514940. Source: OSTI; NTIS (US Sales Only); INIS.

Two examples of application of the general principle to find relaxed states are presented to lead to two new results of the relaxed flow profile given by $\Delta \times u = \kappa u$ in the incompressible viscous fluid and the relaxed state given by $\{ \Delta \times B = \lambda B$ and $\Delta \times u = \kappa u \}$ in the incompressible viscous MHD fluid. The former result suggests that some common phenomena are expected to be observed in the reversed field pinch plasma and in the incompressible viscous fluid. The latter one is expected to have some connections with the field profile of B and the flow pattern of u in the magmas as a result of the earth dynamo. (author).

20409 (PPPL–2836) **Third harmonic generation with ultra-high intensity laser pulses.** Rax, J.M.; Fisch, N.J. Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013245. Source: OSTI; NTIS; INIS; GPO Dep.

When an intense, plane-polarized, laser pulse interacts with a plasma, the relativistic nonlinearities induce a third harmonic polarization. A phase-locked growth of a third harmonic wave can take place, but the differences between the nonlinear dispersion of the pump and driven waves leads to a rapid unlocking, resulting in a saturation. What becomes third harmonic amplitude oscillations are identified here, and the nonlinear phase velocity and the renormalized electron mass due to plasmon screening are calculated. A simple phase-matching scheme, based on a resonant density modulation, is then proposed and analyzed.

20410 (PPPL–2838) **Compton harmonic resonances, stochastic instabilities, quasilinear diffusion, and collisionless damping with ultra-high intensity laser waves.** Rax, J.M. Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013247. Source: OSTI; NTIS; INIS; GPO Dep.

The dynamics of electrons in two-dimensional, linearly or circularly polarized, ultra-high intensity (above 10^{18}W/cm^2) laser waves, is investigated. The Compton harmonic resonances are identified as the source of various stochastic instabilities. Both Arnold diffusion and resonance overlap are considered. The quasilinear kinetic equation, describing the evolution of the electron distribution function, is derived, and the associated collisionless damping coefficient is calculated. The implications of these new processes are considered and discussed.

20411 (PPPL–2839) **TSC simulation of ohmic discharges in TFTR.** Jardin, S.C.; Bell, M.G.; Pomphrey, N. Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013249. Source: OSTI; NTIS; INIS; GPO Dep.

The Tokamak Simulation Code (TSC) has been used to model the time dependence of several ohmic discharges in the TFTR experiment. We have refined the semi-empirical thermal conductivity model and the sawtooth model in TSC so that good agreement is obtained between the simulation and the experiment in electron and ion temperature profiles, and in the current profiles for the entire duration of the discharges. Neoclassical resistivity gives good agreement with the measured surface voltages and rate of poloidal flux consumption.

20412 (PPPL–2840) **Heat transport in PBX-M high β_p plasmas.** LeBlanc, B. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Kaye, S.; Bell, R.; Fishman, H.; Hatcher, R.; Kaita, R.; Kessel, C.; Kugel, H.; Okabayashi, M.; Paul, S.; Sauthoff, N.; Sesnic, S.; Takahashi, H.; Asakura, N.; Duperrex, P.; Gammel, G.Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013248. Source: OSTI; NTIS; INIS; GPO Dep.

PBX-M high beta poloidal discharges routinely transition into the H-mode regime: typically, a quiescent phase followed by an MHD active phase characterize the H-mode period. An analysis of the energy transport during these phases is conducted using the experimental data and the TRANSP code; effective diffusivities are computed to quantify the energy transport of the thermal component of the plasma. Compared to the L-mode, the quiescent H-phase is characterized by a decrease of the thermal ion energy transport and a flattening of the associated effective diffusivity profile. An error analysis is presented. Enhanced fast-ion losses are observed during the MHD active phase: particles in the lower end of the fast-ion energy spectrum with large perpendicular velocity component are predominantly affected. These losses must be taken into account in the analysis in order to reproduce the measured stored energy and time evolution of the neutron production rate during the MHD active phase.

20413 (SAND–92-0066C) **Analyzing noisy spectral line shapes.** Filuk, A.B.; Bailey, J.E. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–10: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011153. Source: OSTI; NTIS; GPO Dep.

In many situations it in necessary to analyze spectral line shapes where the data contain significant amounts of noise or statistical fluctuations. Our visible spectroscopy measurements exploring ion diode physics on the PBFA II accelerator typically result in noisy spectra because the harsh environment limits the number of photons collected. The spectral line profiles include contributions from Doppler (T~1-3 keV). Stark (n_e~10^{17} cm^{-3}), and instrument broadening, as well as from Stark shifting (E~3-10 MV/cm) and Zeeman spliting (B~2-10 T). We extract information about the physical parameters (e.g. ion temperature from Doppler broadening) by determining a range of fits that are consistent with the data, including the uncertainty due to the noise. The range of fits is generated by a Monte-Carlo technique. This method effectively distinguishes between actual spectral features and artifacts due to noise. It provides not only estimates of physical parameters, but also their uncertainties. We evaluated the technique over a range of signal-to-noise ratios and found that it works well for our application. 7 refs.

20414 (SAND–92-0189C) **Absolute calibration of a total yield indium activation detector for DD and DT neutrons.** Ruiz, C.L. (Sandia National Labs., Albuquerque, NM (United States)); Leeper, R.J.; Schmidlapp, F.A.; Cooper, G.; Malbrough, D.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–5: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92010775. Source: OSTI; NTIS; INIS; GPO Dep.

Progress in Z-pinch experiments at Sandia's Saturn Facility have underscored a need for an absolute yield measurement for DD fusion neutrons. The technique chosen for making this absolute yield measurement was neutron activation of indium metal samples. To calibrate the technique, a 175 keV deuteron beam was allowed to impinge on a 3.0-micron thick erbium deuteride target, producing neutrons through the ^{2}H(d,n)^{3}He fusion reaction. The neutron flux produced at 0 degrees and incident on nominal 5 gram indium samples was determined by the associated particle method. This method employed protons measured from the ^{2}H(d,p)^{3}H reaction to infer the neutron flux produced. After neutron irradiation, the activity of the indium samples was measured with a Ge gamma-ray detector. The total activity of the metastable state ^{115m}In(336.23 keV) was measured, compared with the total incident flux, and a calibration factor determined. For completeness, a calibration factor for DT neutrons from the ^{3}H(d,n)^{4}He fusion reaction was also obtained through the measured activity of the metastable state in ^{114m}In(190.29 keV). The experiment and the measured calibration factors for both reactions are described in the paper.

20415 (SFB-191–12-B3-91) **High energy electron generation in surface wave produced plasmas.** Aliev, Yu.M. (Academy of Sciences, P.N. Lebedev Physical Inst., Moscow (USSR)); Bychenkov, V.Yu.; Maximov, A.V.; Schlueter, H. Bochum Univ. (Germany). Sonderforschungsbereich 191 - Physikalische Grundlagen der Niedertemperaturplasmen. Nov 1991. 20p. Order Number DE92516968. Source: OSTI; NTIS (US Sales Only); INIS.

A theoretical model predicting production of hot electrons in the high frequency field of surface wave produced plasmas is presented. The fast particle generation is caused by the radial component of the surface wave electric field near the boundary of the discharge by mechanisms not considered so far. As a result of acceleration due to the interaction with the surface wave field and due to energy loss by excitation and ionization of atoms in the main volume of the plasma the hot electron tail of the energy distribution funtion is formed. Such distributions are calculated for some simple models of inelastic collisions. Effective temperatures are found. The proposed mechanism of hot electron generation are described for cases where the wave frequency is larger than the electron collision frequency. (orig.).

20416 (TRITA-ALF–91-01) **Progress report 1990/91 of the Division of Fusion Plasma Physics.** Lehnert, B. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Aug 1991. 26p. Order Number DE92628696. Source: OSTI; NTIS (US Sales Only); INIS.

A summary is given of the historical background, research, education and available resources of the Division of Fusion Plasma Physics at the newly established Alfven Laboratory. Experimental and theoretical research is performed, including basic physics of magnetized plasma as well as applications to magnetically confined fusion plasma, and to certain technical and cosmical problems. The major project consists of the 'Extrap' high-beta confinement scheme within which a large experimental facility, EXTRAP T2, is under preparation. This research is performed in terms of extensive international collaboration and commitments, in particular with the European Community (Euratom). The education includes pregraduate and postgraduate teaching, the latter being based on obligatory, optional and extra courses which are connected with the research activities.

20417 (TRITA-ALF–91-02) **M=0 Z-Pinch stability reconsidered.** Scheffel, J. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics); Coppins, M. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Aug 1991. 16p. Order Number DE92628706. Source: OSTI; NTIS (US Sales Only); INIS.

The m=0 linear stability of the collisionless, small Larmor radius Z-pinch is examined. By using a generalized form of the energy principle it is shown that a finite pressure external gas can stabilize the pinch. Equilibrium skin currents are always destabilizing. Our results clarify why the gas-embedded pinch and Extrap are m=0 stable, whereas the fibre and compressional pinches are not.

20418 (TRITA-EPP–91-04) **Experimental observations of anomalous potential drops over ion density cavities.** Bohm, M. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics. Aug 1991. 32p. Order Number DE92628702. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments are reported showing the plasma potential response when a step voltage is applied over the plasma column between the two plasma sources in a triple plasma machine. The time resolution is sufficient to resolve potential variations caused essentially by the electron motion, and two independent probe methods are used to obtain this time resolution. Depending on the initial conditions two different responses were observed on the time scale of the electron motion. When the initial ion density varies along the plasma column and has a local minimum (that is, forms an ion density cavity), the applied potential drop becomes distributed over the cavity after a few electron transit times. Later the profile steepens to a double layer on the time scale of the ion motion. The width of the cavity is comparable to the length of the plasma column. When the initial density is axially uniform, most of the potential drop instead concentrates to a narrow region at the low potential end of the plasma column after a few electron transit times. On the time scale of the ion motion this potential drop begins to propagate into the plasma as a double layer. The results obtained are consistent with those from numerical simulations with similar boundary conditions. Further experiments are necessary to get conclusive insight into the voltage supporting capability of an ion density cavity. (au) (34 refs.).

20419 (UCLA/PPG–1200-Vol.2, pp. 5.1-5.57) **Burning-plasma simulations.** Najmabadi, F. (Univ. of California, Los Angeles (United States)); Cooke, P.I.H.; Vold, E.L.; Bathke, C.G.; Miller, R.L.; Werley, K.A.; Kelleher, W.P. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

Extensive studies of the TITAN burning plasma have been performed in order to analyze the plasma behavior and performance (e.g., equilibrium, stability, and transport), and to study key plasma-support systems (e.g., current drive, fueling, impurity control, and particle exhaust). As a whole, these analyses provided detailed descriptions of the burning plasma for all engineering activities and design efforts. The results also provided information to the system analysis activity for improving parametric systems models that were then used to generate new cost-optimized design points for further conceptual design and analysis. The TITAN burning-plasma simulations incorporate the latest understanding and models developed for reversed-field pinches (RFPs), in several cases, new and improved models had to be developed for the TITAN study. Because of the relative lack of theoretical and experimental data bases for RFPs, the sensitivity of the design point to various physics assumptions has also been investigated. The TITAN burning-plasma simulations include analyses of the equilibrium and stability of the TITAN plasma. These equilibrium analyses were performed using a large-aspect-ratio approximation. Two-dimensional equilibrium analysis, however, was also performed to substantiate the accuracy of such an approximation for the TITAN effort. The TITAN plasma operates with a highly radiative core plasma, deliberately doped with xenon impurities, to reduce the heat flux on the divertor plates. Therefore, one-dimensional transport simulations of the TITAN core plasma were performed to study the behavior of highly radiative core plasmas and are reported.

20420 (UCLA/PPG–1200-Vol.2, pp. 7.1-7.41) **Current drive.** Bathke, C.C. (Los Alamos National Lab., NM (United States)); Krakowski, R.A.; Takkuen Mau. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

A number of current-drive options for the RFP have been considered. Although the use of radio-frequency (RF) fast-wave current-drive scheme has not been fully explored for the RFP, the high plasma density and currents relative to those for the tokamak indicate problems with the efficiency of RF current-drive schemes. On the other hand, because of the relaxation processes in RFPs, there is no need to drive the current at the plasma center and some of the issues related to wave penetration may be negated. Bootstrap current is also expected to be low, if such current exists at all in RFPs, since β_θ and $\epsilon = r_p/R_T$ are small relative to the tokamak. The close coupling of poloidal and toroidal currents and magnetic fields that determine the near-minimum-energy states of the RFP offers the possibility of a current-drive method based on magnetic helicity injection because the resistive decay of plasma current can be viewed as a dissipation of magnetic helicity. For the TITAN reactors, helicity injection by the oscillating-field current drive (OFCD) has been selected as the means to sustain the toroidal plasma current. From a theoretical viewpoint, the required physics processes for OFCD in RFPs are identified, several numerical simulations are summarized, and some experimental data on OFCD are also available. An analogue circuit model for OFCD is presented and is used to investigate parametrically the characteristics of the OFCD system for the TITAN reactor. Design points for TITAN-I and TITAN-II are suggested.

20421 (UCRL-CR–107774) **Remote experimental site concept for diagnostic collaborations in fusion.** Casper, T.A. Lawrence Livermore National Lab., CA (United States). Aug 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910857–9: International School of Plasma Physics Piero Caldirola' diagnostics for contemporary fusion experiments, Varenna (Italy), 27 Aug - 6 sep 1991). Order Number DE92010437. Source: OSTI; NTIS; INIS; GPO Dep.

The next generation of tokamaks, ITER or BPX, will be characterized by an even greater emphasis on joint operation and experimentation. With anticipation of an increased number and diversity of collaborations, especially in the area of diagnostics, we are preparing for such shared facilities by developing a systematic approach to remote, joint physics operation involving experimental teams at several locations. The local area network of computers used for control and data acquisition on present and future experiments can be extended over a wide area network to provide a mechanism for remote operation of subsystems (e.g. diagnostics) required for physics experiments. The technology required for high bandwidth ($\geq$45Mbps) connections between multiple sites either exists or will be available over the next few years. With the rapid development of high performance workstations, network interfaces, distributed computing, and video conferencing, we can proceed with the development of a system of control and analysis sites to provide for consistent, efficient, and continuing collaborations. Early establishment of such sites could also enhance existing joint design and development efforts.

20422 (UCRL-CR–110157) **Annual progress report for the fiscal year 1991 and CUSP catastrophe in advanced two chamber model.** Punjabi, A. (Hampton Univ., VA (United States)). Lawrence Livermore National Lab., CA (United States); Hampton Univ., VA (United States). Jun 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011945. Source: OSTI; NTIS; GPO Dep.

This year the research efforts were concentrated on the Advanced Two Chamber Model for DIII-D. We have written two codes ADVTCM1 and ADVTCM2 to solve the equations of this advanced model. Both codes have been tested and debugged. At present, we are studying this model in detail using these two codes. This report discusses this model.

20423 (UCRL-JC–108974) **Fifteen chord FIR polarimetry system on MTX.** Rice, B.W. Lawrence Livermore National Lab., CA (United States). Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920362–22: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011296. Source: OSTI; NTIS; INIS; GPO Dep.

A far-infrared (FIR) polarimeter diagnostic has been added to an existing fifteen chord interferometer on the Microwave Tokamak Experiment (MTX). The polarimeter utilizes a new technique for determination of the Faraday rotation angle based on phase measurements of a rotating polarization ellipse. This technique allows the rotation angle to be determined even in the presence of signal amplitude variations caused by refraction. The implementation of this instrument requires no new detectors and minimal optics, making it quite inexpensive to add on to existing multichord interferometers. The MTX polarimeter has been operating for about a year and has achieved a resolution of $\leq$0.2 degrees with a bandwidth of $\simeq$1 kHz and a chord spacing of 1.5 cm. Typical Faraday rotation angles on MTX are in the range of 5–15 degrees. To obtain the poloidal field, the line-integrated density and Faraday rotation profiles are inverted in a manner consistent with the Grad-Shafranov equilibrium to first order in the inverse aspect-ratio expansion. Profile measurements during normal ohmic operation are presented.

20424 (UCRL-JC–109095) **Woelter x-ray microscope characterization measurements on Nova.** Remington, B.A.; Glendinning, S.G.; Wallace, R.J.; Rothman, S.; Morales, R. Lawrence Livermore National Lab., CA (United States). 6 Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920362–28: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92013207. Source: OSTI; NTIS; GPO Dep.

We have made in situ measurement of the spatial resolution function for two sectors of the 22X magnification Woelter x-ray microscope. Our experimental technique using backlit grid shot on the Nova laser and our method of analysis are described.

20425 (UW-CPTC–92-1) **Ideal ballooning stability near an equilibrium magnetic island.** Hegna, C.C.; Callen, J.D. Wisconsin Univ., Madison, WI (United States). Center for Plasma Theory and Computation. Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER53218. Order Number DE92011730. Source: OSTI; NTIS; INIS; GPO Dep.

The stability properties of ideal ballooning modes on toroidal flux surfaces near a quasistatic magnetic island is examined. On these surfaces, magnetic field-line trajectories tend to bunch on that part of the magnetic surface closet to the X-point of the magnetic island. Because of this preferential bunching, the stabilizing effect of field-line bending due to magnetic shear can be reduced. Eigenfunctions localized in helical angle near the X-point and in poloidal angle on the bad curvature side of the tokamak are more susceptible to ballooning instability than are modes in corresponding equilibria without the magnetic island. For a slowly growing island, a growing number of flux surfaces located near the separatrix become ballooning unstable. Secondary ballooning instabilities may play a part in the crash phase of sawteeth or macroscopic island dynamics.

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Refer also to citation(s) 18131, 18886, 19131, 19162, 20258, 20355, 20371, 20372, 20413, 20419, 20422, 20565

20426 (CONF-910460–2-Vugraphs) **Stochastic broadening in the divertor region using the standard map.** Punjabi, A. (Hampton Univ., VA (United States)); Verma, A.; Boozer, A. Hampton Univ., VA (United States). [1991]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-90ER54106 ;FG05-88ER53265. From International Sherwood fusion theory conference; Seattle, WA (United States); 22-24 Apr 1991. Order Number DE92013227. Source: OSTI; NTIS; INIS; GPO Dep.

Although perturbations give a stochastic region about a separatix, it is not clear whether the image of the separatix on the strike plate of a tokamak divertor is broadened or becomes a complicated curve. To address this issue we are using the standard map and a continuous analogy. When the parameter k of the standard map is close to unity, the topology of the double null divertor is faithfully reproduced. To led the trajectories into the separatix region, we start in a region of good surfaces. But, in addition to the standard map we add a small diffusive term to the iteractions. We are studying the width of the region intercepted by the field lines on the equivalent of the divertor strike plates in the limit as the diffusion coefficient goes to zero. We have found that this width is independent of the diffusion coefficient.

20427 (CONF-9105202–, pp. 7, Paper 7) **Directions for computing for experimental fusion research.** Zarnstorff, M.C. (Princeton Univ., NJ (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

Computers have become a fundamental tool at all stages of experimental fusion research, and are crucial for engineering design, process control and safety monitoring, data acquisition, data analysis, and group communication. The role of computers in experimental fusion research continues to evolve, and to change the manner of the research itself. Here, the authors will outline the present direction of evolution for two areas: data analysis and group communication. TFTR is taken as an example for discussing the present situation, but most of the perspectives are common to other fusion experiments.

20428 (CONF-9105202–, pp. 6, Paper 19) **Progress development of a numerical tokamak.** Brackbill, J.U. (Los Alamos National Lab., NM (United States)). USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff. [1991]. From 1. energy research power supercomputer users symposium; Gaithersburg, MD (United States); 21-22 May 1991. In *Proceedings of the first energy research power supercomputer users symposium.* 173p. Order Number DE91018877. Source: OSTI; NTIS; INIS.

The development of highly concurrent computers is causing a revolution in numerical modeling. One can now anticipate a time when constraints on computational power are removed. That anticipation motivates the identification of grand challenge problems, those problems which combine significance and generality, and benefit from enormous computing power. Magnetic confinement fusion faces a grand challenge problem that will stimulate the energy and creativity of the entire community of computational physicists. That challenge is the developmental of a numerical model for a Tokamak. The successful modeling of a Tokamak would lead to a better understanding of the operation of these machines. As John Dawson comments, it would give much greater confidence in the predicted machine performance; it would provide the capability to test out their new ideas and machine improvements without committing them to hardware, and it would be a powerful tool for machine builders. Since success with the Tokamak is the principal hope for magnetic fusion in the foreseeable future, real contributions from numerical modeling would be invaluable. There is agreement on certain essential components of Tokamak physics.

The modeling of Tokamaks requires the means to represent complex geometries, long-range interaction of charged particles through electric and magnetic fields, non-equilibrium, plasma phenomena, and the nonlinear interaction of many complex and dissimilar processes. It is clear that no one method can encompass all of the physics of a Tokamak. However, because of the range of plasma conditions encountered in a tokamak, there is reason to believe that plasma simulation using the full kinetic equations has the greatest chance of achieving this goal.

20429 (CONF-9108146–2) **Millimeter wave free electron laser amplifiers: Experiments and designs.** Bidwell, S.W. (Maryland Univ., College Park, MD (United States). Lab. for Plasma Research); Zhang, Z.X.; Antonsen, T.M. Jr.; Bensen, D.M.; Destler, W.W.; Granatstein, V.L.; Lantham, P.E.; Levush, B.; Rodgers, J.; Freund, H.P.; Radack, D.J. Maryland Univ., College Park, MD (United States). Lab. for Plasma Research. [1991]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER52147. From 16. international conference on infrared and millimeter waves; Lausanne (Switzerland); 26-30 Aug 1991. Order Number DE92011813. Source: OSTI; NTIS; INIS; GPO Dep.

Free electron laser amplifies are investigated as sources of high-average-power (1 MW) millimeter to submillimeter wave radiation (200 GHz - 600 GHz) for application to electron cyclotron resonance heating of magnetically confined fusion plasmas. As a stepping-stone to higher frequencies and cw operation a pulsed amplifier ($\tau_{pulse} \simeq 80$ ns) at 98 GHz is being developed. Status is reported on this experiment which investigates linear gain amplification with use of sheet electron beam (transverse cross section = 0.1 cm × 2.0 cm, $V_{beam} = 440$ keV, $I_{beam} \simeq 10$ A) and short-period wiggler ($\ell_w = 0.96$ cm) and with expected output of 140 W. Predictions of gain and efficiency from a 1-D universal formulation are presented. Beam propagation results, with wiggler focusing as a means of sheet beam confinement in both transverse dimensions, through the 54 cm (56 period) pulsed electromagnet wiggler are discussed. Peak wiggler fields of 5.1 kG on-axis have been achieved.

20430 (CONF-920311–Absts.) **Tenth International conference on plasma surface interactions in controlled fusion devices: Program and abstracts.** Sandia National Labs., Albuquerque, NM (United States). [1992]. 290p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. From 10. international conference on plasma-surface interactions in controlled fusion devices; Monterey, CA (United States); 30 Mar - 3 apr 1992. Order Number DE92012142. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the program and abstracts for the 10th international conference on plasma surface interactions in controlled fusion devices. (LSP).

20431 (CONF-920395–1) **The ORNL point of view on the direction of the US Fusion Program.** Fulkerson, B. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Fusion energy advisory committee meeting; Princeton, NJ (United States); 18-19 Mar 1992. Order Number DE92011080. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. THERMONUCLEAR REACTIONS/technology assessment; TOKAMAK DEVICES

20432 (CONF-920417–2) **An overview of remote handling technology in today's fusion experiments.** Burgess, T.W. (Oak Ridge National Lab., TN (United States)); Davis, F.C.; Loesser, G.D.; Walton, G.R. Oak Ridge National Lab., TN (United States). [1992]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AC02-76CH03073. From ANS executive conference on remote operations and robotics in the nuclear industry II; Pine Mountain, GA (United States); 5-8 Apr 1992. Order Number DE92011777. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains viewgraphs on the use of remote handling techniques for maintenance in fusion reactors. (LSP)

20433 (CONF-920458–7) **Slow strain rate tensile tests in high temperature water of spectrally tailored irradiated type 316 materials for fusion reactor applications.** Tsukada, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Shiba, K.; Nakajima, H.; Bell, G.E.C. Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Corrosion '92 conference and exhibition; Nashville, TN (United States); 27 Apr - 1 may 1992. Order Number DE92011783. Source: OSTI; NTIS; INIS; GPO Dep.

The susceptibility of neutron irradiated type 316 stainless to stress corrosion cracking in oxygenated pure water was investigated by Slow Strain Rate Technique (SSRT). The specimens had been irradiated to 8 dpa in the Oak Ridge Research Reactor (ORR) under fusion spectrally tailored condition to simulate radiation environment expected in the near-term water-cooled fusion reactor at temperatures of 60, 200, 330 and 400°C. SSRT tests were conducted at the same temperatures with irradiation for specimens irradiated at 60 and 200°C and at 300°C for specimens irradiated at 330 and 400°C. Intergranular cracks was observed on the specimens irradiated at higher two temperatures, while the specimens irradiated at lower two techniques showed completely ductile fracture. Crack initiation by transgranular type fracture was observed. On fractured grain facets apparent slip steps formed. Results of the SSRT were compared with those from specimens irradiated under LWR conditions and discussed.

20434 (CONF-920607–5) **A comparison of two three-dimensional shell-element transient electromagnetics codes.** Yugo, J.J.; Williamson, D.E. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. topical meeting on technology of fusion energy; Boston, MA (United States); 7-12 Jun 1992. Order Number DE92010686. Source: OSTI; NTIS; INIS; GPO Dep.

Electromagnetic forces due to eddy currents strongly influence the design of components for the next generation of fusion devices. An effort has been made to benchmark two computer programs used to generate transient electromagnetic loads: SPARK and EddyCuFF. Two simple transient field problems were analyzed, both of which had been previously analyzed by the SPARK code with results recorded in the literature. A third problem that uses an ITER inboard blanket benchmark model was analyzed as well. This problem was driven with a self-consistent, distributed multifilament plasma model generated by an axisymmetric physics code. The benchmark problems showed good agreement between the two shell-element codes. Variations in calculated eddy currents of 1–3% have been found for similar, finely meshed models. A difference of 8% was found in induced current and 20% in force for a coarse mesh and complex, multifilament field driver. Because comparisons were made to results obtained from literature, model preparation and code execution times were not evaluated.

20435 (CONF-920607–9) **Small tokamaks for fusion technology testing.** Peng, Y.K.M.; Galambos, J.D.; Shipe, P.C. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. topical meeting on technology of fusion energy; Boston, MA (United States); 7-12 Jun 1992. Order Number DE92011790. Source: OSTI; NTIS; INIS; GPO Dep.

Small steady-state tokamaks for testing divertors and fusion nuclear technologies are considered. Based on present physics and technology data and explanation to reduce R_0/a, H-D-fueled tokamaks with $R_0 \sim 0.6–0.75$ m, $R_0/a \sim 1.8–2.5$, and $B_{t0} \sim 1.4–2.2$ T can be driven with $P_{tot} \sim 4.5$ MW to maintain $I_p \sim 0.5$ MA and produce the ITER-level plasma edge and divertor conditions. Given an adequate steady-state divertor solution and Q~1 operation based on fusion through the suprathermal component, D-T-fueled tokamaks with $R_0 \sim 0.8$ m, $R_0/a \sim 2$, and $B_{t0} \sim 4$ T can be driven with $P_{tot} \sim 15$ MW to maintain $I_p \sim 4.6$ MA and produce an peak neutron wall load $W_L \sim 1$ MW/m^2. Such devices appear possible if the plasma properties at the power R_0/a remain tokamak-like and, for the D-T case, can unshielded center core is feasible. The use of a single conductor as the inboard leg of the toroidal field coils for this purpose is discussed. The physics issues and the design features are identified for such tokamaks with a testing duty for factor goal of 10–20%.

20436 (CONF-920628-2-Extd.Abst.) **Radiation damage in carbon-carbon composites.** Burchell, T.D.; Eartherly, W.P.; Nelson, G.E. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International conference on carbon: carbon '92; Essen (Germany); 22-26 Jun 1992. Order Number DE92011778. Source: OSTI; NTIS; INIS; GPO Dep.

Graphite and carbon-carbon composite materials are widely used in plasma facing applications in current Tokamak devices such as TFTR and DIIID in the USA, JET, Tore Supra and TEXTOR in Europe, and JT-60U in Japan. Carbon-carbon composites are attractive choices for Tokamak limiters and diverters because of their low atomic number, high thermal shock resistance, high melting point, and high thermal conductivity. Next generation machines such as the International Thermonuclear Experimental Reactor (ITER) will utilize carbon-carbon composites in their first wall and diverter. ITER will be an ignition machine and thus will produce substantial neutron fluences from the D-T fusion reaction. The resultant high energy neutrons will cause carbon atom displacements in the plasma facing materials which will markedly affect their structure and physical properties. The effect of neutron damage on graphite has been studied for over forty years. Recently the effects of neutron irradiation on the fusion relevant graphite GraphNOL N3M was reviewed. In contrast to graphite, relatively little work has been performed to elucidate the effects of neutron irradiation on carbon-carbon composites. The results of our previous irradiation experiments have been published elsewhere. Here the irradiation induced dimensional changes in 1D, 2D, and 3D carbon-carbon composites are reported for fluences up to 4.7 dpa at an irradiation temperature of 600°C.

20437 (CONF-920673-3-Extd.Abst.) **The effect of neutron irradiation on the structure and properties of carbon-carbon composite materials.** Burchell, T.D.; Eatherly, W.P.; Strizak, J.P. Oak Ridge National Lab., TN (United States). [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 16. annual symposium of American Society of Testing and Materials (ASTM); Denver, CO (United States); 21-22 Jun 1992. Order Number DE92011670. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. GRAPHITE/damaging neutron fluence; THERMONUCLEAR REACTOR MATERIALS/physical radiation effects; GRAPHITE; DIVERTORS; LIMITERS; TOKAMAK DEVICES

20438 (DOE/DP/40200-188) **LLE review: Quarterly report, October-December 1991: Volume 49.** Keck, R.L. (ed.). Rochester Univ., NY (United States). Lab. for Laser Energetics. [1991]. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC03-85DP40200. Order Number DE92011614. Source: OSTI; NTIS; GPO Dep.

This volume of the LLE Review, covering the period October-December 1991, contains articles on the analysis of argon-filled target experiments, and a theoretical analysis of the impact of nonlocal heat transport in laser filamentation in plasmas. In the Advanced Technology section there is an article on mechanisms that affect thin-film conductivity, and a report on the gain characteristics of the 20-cm SSA prototype amplifier to be used in the OMEGA Upgrade. Finally, the activities of the National Laser Users Facility and the GDL and OMEGA laser facilities are summarized. Highlights of the research reported in this issue are: argon radiation from argon-filled, polymer-shell targets is used as a core-temperature diagnostic and density diagnostic of the surrounding region in a regime where the argon line radiation is strongly absorbed. A theoretical analysis of the impact of nonlocal heat transport on laser filamentation in plasmas is developed. The resulting model is compared with experimental observations and the implications for ICF are discussed. A study of thermal conductivity in thin films seeks to identify mechanisms that result in degradation of thin-film conductivity. Identifying these mechanisms can lead to changes in the thin-film manufacture that will improve their resistance to laser damage.

20439 (DOE/ER/52147-5) **Microwave generation for magnetic fusion energy applications: Progress report, September 15, 1991-July 15, 1992.** Antonsen, T.M. Jr.; Destler, W.W.; Granatstein, V.L.; Levush, B. Maryland Univ., College Park, MD (United States). Jan 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER52147. Order Number DE92011424. Source: OSTI; NTIS; INIS; GPO Dep.

This progress report encompasses work on two separate projects, both related to developing sources for electron cyclotron resonance heating of magnetic fusion plasmas. The report is therefore divided into two parts as follows: Free electron laser with small period wigglers; and theory and modeling of high frequency, high power gryotron operation. Task A is experimental and eventually aims at developing continuously tunable, cw sources for ECRH with power per unit as high as 5 megawatts. Task B provides gryotron theory and modeling in support of the gryotron development programs at MIT and Varian.

20440 (DOE/ER/54091-1) **Boundary plasma transport studies on TFTR: Final report, September 1990-September 1991.** Pitcher, C.S.; Stangeby, P.C. Canadian Fusion Fuels Technology Project, Mississauga, ON (Canada). Nov 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-90ER54091. (CFFTP-G-91112). Order Number DE92011942. Source: OSTI; NTIS; INIS; GPO Dep.

In this report we summarize the experimental and theoretical investigations supported under the DOE Transport Initiative Contract on the subject of Boundary Plasma Transport Studies on TFTR. This work can be logically separated into two areas of investigations and therefore the report included here is divided into two parts. First, in Section I, detailed boundary plasma data obtained from TFTR in an Ohmic density scan has been compared with results from the LIM Impurity Production and Transport Code. Second, in Section II, experimental results taken with the newly-purchased (specifically for this Initiative) intensified CCD camera are presented, which, after comparison with simple modeling, reveals a new and important effect that has implications for limiter and divertor plate design.

20441 (EGG-FSP-9865) **A comparison of dose and dose-rate conversion factors from the Soviet Union, United Kingdom, US Department of Energy, and the Idaho National Engineering Laboratory Fusion Safety Program.** Rood, A.S.; Abbott, M.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012221. Source: OSTI; NTIS; INIS; GPO Dep.

Several independent data sets of radiological dose and dose-rate conversion factors (DCF/DRCF) have been tabulated or developed by the international community both for fission and fusion safety purposes. This report compares sets from the US Department of Energy, the Soviet Union, and the United Kingdom with those calculated by the Idaho National Engineering Laboratory Fusion Safety Program. The objectives were to identify trends and potential outlying values for specific radionuclides and contribute to a future benchmark evaluation of the CARR computer code. Fifty-year committed effective dose equivalent factors were compared for the inhalation and ingestion pathways. External effective dose equivalent rates were compared for the air immersion and ground surface exposure pathways. Comparisons were made by dividing dose factors in the different data bases by the values in the FSP data base. Differences in DCF/DRCF values less than a factor of 2 were considered to be in good agreement and are likely due to the use of slightly different decay data, variations in the number of organs considered for calculating CEDE, and rounding errors. DCF/DRCF values that differed by greater than a factor of 10 were considered to be significant. These differences are attributed primarily to the use of different radionuclide decay data, selection and nomenclature for different isomeric states, treatment of progeny radionuclides, differences in calculational methodology, and assumptions on a radionuclide's chemical form.

20442 (EGG-FSP-9977) **Magnet operating experience review for fusion applications.** Cadwallader, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012531. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a review of magnet operating experiences for normal-conducting and superconducting magnets from fusion, particle accelerator, medical technology, and magnetohydrodynamics research areas. Safety relevant magnet operating experiences are presented to provide feedback on field performance of existing designs and to point out the operational safety concerns. Quantitative estimates of magnet component failure rates and accident event frequencies are also presented, based on field experience and on performance of similar components in other industries.

20443 (EGG-FSP–10017) **Beryllium technology workshop, Clearwater Beach, Florida, November 20, 1991.** Longhurst, G.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 239p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9111209–: Beryllium technology workshop, Clearwater Beach, FL (United States), 20 Nov 1991). Order Number DE92012312. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: beryllium in the ITER blanket; mechanical testing of irradiated beryllium; tritium release measurements on irradiated beryllium; beryllium needs for plasma-facing components; thermal conductivity of plasma sprayed beryllium; beryllium research at the INEL; Japanese beryllium research activities for in-pile mockup tests on ITER; a study of beryllium bonding of copper alloy; new production technologies; thermophysical properties of a new ingot metallurgy beryllium product line; implications of beryllium:steam interactions in fusion reactors; and a test program for irradiation embrittlement of beryllium at JET.

20444 (EGG-FSP–10048) **Cryogenic system operating experience review for fusion applications.** Cadwallader, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012509. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a review of cryogenic system operating experiences, from particle accelerator, fusion experiment, space research, and other applications. Safety relevant operating experiences and accident information are discussed. Quantitative order-of-magnitude estimates of cryogenic component failure rates and accident initiating event frequencies are presented for use in risk assessment, reliability, and availability studies. Safety concerns with cryogenic systems are discussed, including ozone formation, effects of spills, and modeling spill behavior. This information should be useful to fusion system designers and safety analysts, such as the team working on the International Thermonuclear Experimental Reactor design.

20445 (ENEA-RT-INN–90-35) **1st ENEA report on extreme UV single pass high gain free electron laser driven by self triggered harmonic generation in oscillator regime. Part 2: general design considerations.** Barbini, R.; Ciocci, F.; Dattoli, G.; Dipace, A.; Giannessi, L.; Mari, C.; Ronsivalle, C.; Sabia, E.; Torre, A.; Marino, A. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione; ENEA, Casaccia (Italy). Area Energia e Innovazione; ENEA, Bologna (Italy). Centro Ricerche Energia 'E. Clementel' - Area Energia e Innovazione. May 1991. 39p. (RT/INN–90-35). Order Number DE92506265. Source: OSTI; NTIS (US Sales Only).

This report describes a non conventional FEL consisting of a coupled oscillator and amplifier scheme. This device could extend the FEL tunability below 100 nm. The laser tunability and the high peak power make the system a candidate for the ionization process Bi+ = Bi++, required within the context of inertial fusion projects with ions.

20446 (GA-A–20860) **Real time analysis of tokamak discharge parameters.** Ferron, J.R.; Strait, E.J. General Atomics, San Diego, CA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920362–20: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011394. Source: OSTI; NTIS; INIS; GPO Dep.

The techniques used in implementing two applications of real time analysis of data from the DIII-D tokamak are described. These tasks, which are demanding in both the speed of data acquisition and the speed of computation, execute on hardware capable of acquiring 40 million data samples per second and executing 80 million floating point operations per second. In the first case, a feedback control algorithm executing at a 10 kHz cycle frequency is used to specify the current in the poloidal field coils in order to control the discharge shape. In the second, fast Fourier transforms of Mirnov probe data are used to find the amplitude and frequency of each of eight toroidal mode numbers as a function of time during the discharge. Data sampled continuously at 500 kHz are used to produce results at 2 msec intervals.

20447 (INFN-TC–91-10) **A new scheme for critical current measurements on straight superconducting cables in a large solenoid.** Rossi, L. (Milan Univ. (Italy). Ist. di Fisica); Volpini, G.; Lasa Laboratory. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1991. 15p. Order Number DE92627507. Source: OSTI; NTIS (US Sales Only); INIS.

The precision of I_c measurement of straight superconducting cables in solenoids can be limited by the magnetic field inhomogeneity. A solution in order to improve the field homogeneity based on iron shims is presented here. A conceptual design for the experimental lay-out of a test station to be used in connection with the SOLEMI-I solenoid at the Milan INFN Section (LASA Laboratory) is given.

20448 (IPP–2/313) **Proceedings of the 4th workshop on WENDELSTEIN 7-X.** Junker, J. (ed.). Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Dec 1991. 242p. (CONF-9110379–: 4. workshop on WENDELSTEIN 7-X, Schloss Ringberg (Germany), 28-31 Oct 1991). Order Number DE92517002. Source: OSTI; NTIS (US Sales Only); INIS.

The 4th Workshop on WENDELSTEIN 7-x (28.-31.10.1991) treated the following topics: Coil System (optimization; ripple transport; magnetic fields, forces, stresses; analytic stellarator fields) - equilibrium and stability (computations; equilibrium with dissipation; global MHD stability; resistive ballooning modes) - transport and neutral gas (Pfirsch-Schlueter currents and anomalous transport; general solution of the ripple-averaged equation; the EIRENE neutral gas transport codes; application of DEGAS; CX-losses at NBI) - plasma parameters (alpha particle confinement in stellarators; the radical electric field in W 7) - divertor (structure of the magnetic field line diversion in Helias configurations; divertor studies for W 7; sweep coil system; the island divertor; one-dimensional fluid model and investigation of the plasma boundary layer) - engineering (W 7 status of planning; CAD/CAE applications for W 7; structural analysis of the coil system) - reactor (the Helias reactor) - concluding discussion. (AH).

20449 (KFK–4929) **Status report. KfK contribution to the development of DEMO-relevant test blankets for NET/ITER. Pt. 2: BOT helium cooled solid breeder blanket. Vol. 2. Detailed version.** Dalle Donne, M. (comp.) (Internationale Atomreaktorbau GmbH (INTERATOM), Bergisch Gladbach (Germany)); Adelhelm, C.; Baschek, H.D.; Bogusch, E.; Fritsch, W.; Boccaccini, L.V.; Bojarsky, E.; Deckers, H.; Dienst, W.; Doerr, L.; Fischer, U. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Kernfusion. Oct 1991. 326p. Order Number DE92511178. Source: OSTI; NTIS (US Sales Only); INIS.

The BOT (Breeder Outside Tube) Helium Cooled Solid Breeder Blanket for a fusion Demo reactor and the status of the R and D program is presented. This is the KfK contribution to the European Program for the Demo relevant test blankets to be irradiated in NET/ITER. Volume 1 (KfK 4928) contains the summary, volume 2 (KfK 4929) a more detailed version of the report. In both volumes are described the reasons for the selected design, the reference blanket design for the Demo reactor, the design of the test blanket including the ancillary systems together with the present status of the relative R and D program in the fields of neutronic and thermohydraulic calculations, of the electromagnetic forces caused by disruptions, of the development and irradiation of the ceramic breeder material, of the tritium release and recovery, and of the technological investigations. An outlook is given on the required R and D program for the BOT Helium Cooled Solid Breeder Blanket prior to tests in NET/ITER and the proposed test program in NET/ITER. (orig.).

20450 (KFK–4958) **Current lead and bus bar system for the 1.8 K test of the EURATOM LCT-coil.** Friesinger, G.; Heller, R.; Schappals, L.; Zahn, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Technische Physik; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Kernfusion. Nov 1991. 46p. Order Number DE92511417. Source: OSTI; NTIS (US Sales Only); INIS.

For the test of EURATOM LCT coil at 1.8 K in the TOSKA facility, it is foreseen to use the 23 kA current leds developed for the POLO model coil. Special emphasis has been given to the connection of the current leads which will operate by using supercritical helium at 4.2 K to the coil terminals which are on the 1.8 K level. The heat input from the bus bar system (4.2 K) to the coil winding cooling circiut (1.8 K) for each terminal is only in the range of 10 to 15 W. The calculations show that the current leads together with the superconducting connection bars are safe: They can withstand a loss of mass flow for more than one minute withonly a very small increase of heat load into the coil if its cooling circuit stays in operation. (orig.).

20451 (LA-UR–92-875) **Neutron time-of-flight ion temperature diagnostic for inertial confinement fusion experiments.** Chrien, R.E. (Los Alamos National Lab., NM (United States)); Simmons, D.F.; Holmberg, D.L. Los Alamos National Lab., NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920362–19: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011365. Source: OSTI; NTIS; INIS; GPO Dep.

We are constructing a T_I diagnostic for low neutron yield (5×10^7 to above 10^9) d-d and d-t targets in the Nova facility at Livermore. The diagnostic measures the neutron energy spread with 960 scintillator-photomultiplier detectors located 28 m from the target and operates in the single-hit mode. Each detector can measure a single neutron arrival with time resolution of 1 ns or better. The arrival time distribution is constructed from the results of typically 200–500 detector measurements. The ion temperature is determined from the spread in neutron energy $\Delta E_n \propto T_I^{\frac{1}{2}}$, which is related to the arrival time spread by $\Delta t/t = 1(\frac{1}{2}\Delta E_n/E_n)$. Each neutron arrival is detected by using a photomultiplier tube to observe the recoil proton from elastic scattering in a fast plastic scintillator. The timing electronics for each channel consist of a novel constant fraction-like discriminator and a multiple hit time-to-digital converter (TDC). The overall system design, together with single channel performance data, is presented.

20452 (LBL–31943) **Heavy ion fusion accelerator research (HIFAR) year-end report, April 1, 1991–September 30, 1991.** Lawrence Berkeley Lab., CA (United States). Sep 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–536). Order Number DE92013762. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: ion source for the final focusing scaling experiment; reference ILSE physics design; injector and ion source development; the injector matching section; beam merging in ILSE; short quadrupole magnet design; ILSE concept induction cell studies; fast split-harp emittance measurements using a multichannel waveform analyzer; and HIFAR staff roster.

20453 (NIFS–122) **Status of LHD control system design.** Yamazaki, K.; Kaneko, H.; Taniguchi, Y.; Motojima, O. National Inst. for Fusion Science, Nagoya (Japan). Dec 1991. 18p. Order Number DE92514939. Source: OSTI; NTIS (US Sales Only); INIS.

The present status of LHD (Large Helical Device) control system design is described, emphasizing on the plasma operation modes, the architecture of the LHD control system, the real-time plasma feedback system with PID or Fuzzy controllers and the construction schedule of the LHD control system. The conceptual and designs are under way taking flexible and reliable operations for physics experiments into account. (author).

20454 (PPPL–2837) **Particle reflection and TFTR neutral beam diagnostics.** Kamperschroer, J.H.; Grisham, L.R.; Kugel, H.W.; O'Connor, T.E.; Newman, R.A.; Stevenson, T.N.; von Halle, A.; Williams, M.D. Princeton Univ., NJ (United States). Plasma Physics Lab. Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013246. Source: OSTI; NTIS; INIS; GPO Dep.

Determination of two critical neutral beam parameters, power and divergence, are affected by the reflection of a fraction of the incident energy from the surface of the measuring calorimeter. On the TFTR Neutral Beam Test Stand, greater than 30% of the incident power directed at the target chamber calorimeter was unaccounted for. Most of this loss is believed due to reflection from the surface of the flat calorimeter, which was struck at a near grazing incidence (12°). Beamline calorimeters, of a "V"-shape design, while retaining the beam power, also suffer from reflection effects. Reflection, in this latter case, artificially peaks the power toward the apex of the "V", complicating the fitting technique, and increasing the power density on axis by 10 to 20%; an effect of import to future beamline designers. Agreement is found between measured and expected divergence values, even with 24% of the incident energy reflected.

20455 (PPPL–2841) **Experiments on TFTR supershot plasmas.** Strachan, J.D. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Bell, M.; Janos, A.; Kaye, S.; Kilpatrick, S.; Manos, D.; Mansfield, D.; Mueller, D.; Owens, K; Timberlake, J.; Pitcher, C.S.; Snipes, J. Princeton Univ., NJ (United States). Plasma Physics Lab. May 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92013638. Source: OSTI; NTIS; INIS; GPO Dep.

Improvements to the TFTR limiter have extended the threshold for carbon blooms (an uncontrolled massive influx of carbon) to greater than 32 MW for 1 sec so that blooms seldom occur in present TFTR Supershot experiments. As a result of the progression from strong blooms to modest blooms to no blooms, improvements in confinement could be correlated with the occurrence of a carbon bloom in the plasma which immediately preceded the supershot. It is speculated that the carbon influx during a carbon bloom results in a limiter surface which has a slightly reduced self=sputtering yield for subsequent discharge. The influence on the supershot plasma seems similar to phenomena obtained by conditioning with lithium pellets.

20456 (PPPL–2842) **Scrape-off layer modeling using coupled plasma and neutral transport codes.** Stotler, D.P. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Coster, D.P.; Ehrdardt, A.B.; Karney, C.F.F.; Petravic, M.; Braams, B.J. Princeton Univ., NJ (United States). Plasma Physics Lab. May 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE92014001. Source: OSTI; NTIS; INIS; GPO Dep.

An effort is made to refine the neutral transport model used in the B2 edge plasma code by coupling it to the DEGAS Monte Carlo code. Results are discussed for a simulation of a high recycling divertor. It appears that on the order of 100 iterations between the two codes are required to achieve a converged solution. However, the amount of computer time used in the DEGAS simulations is large, making complete runs impractical for design purposes. On the other hand, the differences in the resulting plasma parameters when compared to the B2 analytic neutrals model indicate that it would be worthwhile to explore techniques for speeding up the control system of codes.

20457 (PPPL-CFP–2605) **Noble gas pumping by the TFTR graphite limiter.** Ramsey, A.T.; Manos, D.M. Princeton Univ., NJ (United States). Plasma Physics Lab. [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-920311–4: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). Order Number DE92012669. Source: OSTI; NTIS; INIS; GPO Dep.

The TFTR limiter is graphite. It is possible to decrease the amount of D trapped in the limiter by making plasma discharges with gas injected only as a prefill. When the limiter is deuterium depleted well enough by this technique for supershots (with $R_D \sim 0.5 - 0.6$) it pumps noble gases. The effective confinement time $\tau_p{}^*$ ranges from ≤ 1 s for He down to 0.08 s for Kr. These noble gases escape from the limiter slowly after the run. The partial pressure of Ar and Ne decay with time-constants of several hours, and the data for Ar show evidence of two trapping sites.

20458 (PSI–110) **Magnetohydrodynamic research in fusion blanket engineering and metallurgical processing.** Tokuhiro, A. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Nov 1991. 60p. Order Number DE92627510. Source: OSTI; NTIS (US Sales Only); INIS.

A review of recent research activities in liquid metal magnetohydrodynamics (LM-MHDs) is presented in this article. Two major reserach areas are discussed. The first topic involves the thermomechanical design issues in a proposed tokamak fusion reactor. The primary concerns are in the magneto-thermal-hydraulic performance of a self-cooled liquid metal blanket. The second topic involves the application of MHD in material processing in the metallurgical and semiconductor industries. The two representative applications are electromagnetic stirring (EMS) of continuously cast steel and the Czochralski (CZ) method of crystal growth in the presence of a magnetic field. (author) 24 figs., 10 tabs., 136 refs.

20459 (SAND–92-0049C) **Measurement of beam properties and reproducibility on recent PBFA II target shots.** Moats, A.R.; Derzon, M.S.; Johnson, D.J.; Nelson, W.E.; Wenger, D.F.; Pantuso, J.G. Sandia National Labs., Albuquerque, NM (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–12: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92011171. Source: OSTI; NTIS; INIS; GPO Dep.

Recent proton experiments on PBFA II used a 2 micron gold foil cone to characterize the ion beam. Using the ion beam images obtained by viewing such foils with time-integrated x-ray pinhole cameras, the beam centroid axial location and azimuthal symmetry have been analyzed for a recent series of target shots. Azimuthal symmetry on the target midplane on individual shots varies from 14%–35%. Averaged over the entire series of shots, inferred intensities on the target midplane vary by 21% to 41% from quadrant to quadrant. The beam profiles and beam reproducibility are vital to the interpretation of the results of these target experiments. A possible correlation between the ion beam full-width-at-half-maximum and the integrated counts from a nuclear activation diagnostic was observed.

20460 (SAND–92-0155C) **An ion movie camera for particle-beam-fusion experiments.** Stygar, W.A.; Mix, L.P.; Leeper, R.J.; Maenchen, J.; Wenger, D.F.; Mattson, C.R.; Muron, D.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–13: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92010669. Source: OSTI; NTIS; INIS; GPO Dep.

A camera with 3-ns time resolution – and a continuous (> 100-ns) record length – has been developed to image a 10^{12}-10^{13} W/cm^2 ion beam for inertial-confinement-fusion experiments. A thin gold Rutherford-scattering foil placed in the path of the beam scatters ions into the camera. The foil is in a near-optimized scattering geometry and reduces the beam intensity seven orders of magnitude. The scattered ions are pinhole imaged onto a 2-D array of 39 p-i-n diode detectors. The output of each detector is recorded on a LeCroy 6880 transient-waveform digitizer. The waveforms are analyzed and combined to produce a 39-pixel movie which can be displayed on an image processor to provide, for example, time-resolved horizontal- and vertical-focusing information.

20461 (SAND–92-0156C) **ICF target diagnostics on PBFA II.** Chandler, G.A. (Sandia National Labs., Albuquerque, NM (United States)); Aubert, J.; Bailey, J.; Carlson, A.; Derzon, D.; Derzon, M.; Dukart, R.; Humphreys, R.; Hunter, J.; Johnson, D.J.; Matzen, M.K.; Moats, A.; Olson, R.; Pantuso, J.; Rockett, P.; Ruiz,.Sandia National Labs., Albuquerque, NM (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920362–26: 9. topical conference on high-temperature plasma diagnostics, Santa Fe, NM (United States), 15-19 Mar 1992). Order Number DE92012626. Source: OSTI; NTIS; INIS; GPO Dep.

PBFA II is a light-ion fusion accelerator that is presently capable of irradiating a 6-mm-diameter sphere with ~50 kJ of 5.5-MeV protons in ~15 ns. An array of particle and x-ray diagnostics fielded on proton ICF target experiments quantifies the incident particle beam and the subsequent target response. An overview of the ion and target diagnostic setup and capabilities will be given in the context of recent proton beam experiments aimed at studying soft x-ray emission from foam-filled targets and the hydrodynamic response of exploding-pusher targets. Ion beam diagnostics indicate ~100 kilojoules of proton beam energy incident within a 1.2-cm radius of the center of the diode with an azimuthal uniformity which varied between 6–29%. Foam-filled target temperatures of 35 eV and closure velocities of 4 cm/μs were measured.

20462 (SAND–92-8489C) **Power scaling of divertor plasma conditions during H-mode in DIII-D.** Buchenauer, D. (Sandia National Labs., Livermore, CA (United States)); Cuthbertson, J.W.; Hill, D.N.; Klepper, C.; Petrie, T.W. Sandia National Labs., Livermore, CA (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-920311–5: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). Order Number DE92012148. Source: OSTI; NTIS; INIS; GPO Dep.

An array of fixed Langmuir probes spanning the inner and outer divertor strike points has been used to measure the electron temperature, plasma density, and particle/heat flux profiles of the divertor plasma in DIII-D. We report here on observations made during the steady state phase of high-power neutral-beam heated H-mode plasmas. These data are important for predicting the expected impurity sources and target-plate material lifetimes in future high power tokamaks such as ITER. H-mode plasmas formed with a high divertor neutral pressure in the absence of external gas feed in DIII-D were found to have beneficial consequences in reducing the peak values of divertor electron temperature without loss of core energy confinement. We have observed a steady-state, high density (^{n}pl, d $\cong 10^{14}$ cm^{-3}), moderate temperature (< 50 eV) divertor plasma in DIII-D at ITER-like divertor power levels of 3 MW/m^2. A better understanding of the importance of ion-neutral and charge-exchange collisions may be needed to interpret these results.

20463 (TRITA-ALF–91-03) **Paramagnetism and diamagnetism in EXTRAP.** Tennfors, E. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Oct 1991. 21p. Order Number DE92628721. Source: OSTI; NTIS (US Sales Only); INIS.

Magnetic field profiles measured in Extrap discharges with an imposed axial/toroidal magnetic field are analysed in the present article. In a linear device, Extrap L1, the axial current is driven by an applied electrode voltage. In the toroidal Extrap T1, the toroidal current is induced. Contributions to the current, and addition to that due to the applied voltage, may arise from radial diffusion as well as from dynamo effects like those observed in reversed field pinches. Typical magnetic field profiles are studied here in order to assess these contributions. (12 refs., 14 figs.).

20464 (UCLA/PPG–1200-Vol.2, pp. 2.1-2.79) **Reversed-field pinch as a fusion reactor.** Krakowski, R.A. (Los Alamos National Lab., NM (United States)); Najmabadi, F. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

The TITAN research program is a multi-institutional effort to determine the potential of the reversed-field-pinch (RFP) magnetic fusion concept as a compact, high-power-density, and attractive fusion energy system from economics safety, environmental, and operational viewpoints. The RFP has inherent characteristics which allow it to operate at very high mass power densities. This potential is available because the main confining field in an RFP is the poloidal field, which is generated by the large toroidal current flowing in the plasma. This feature results in a low field at the external magnet coils, a high plasma beta, and a very high engineering beta as compared to other confinement schemes. Furthermore, sufficiently low magnetic fields at the external coils permit the use of normal coils while joule losses remain a small fraction of the plant output. This option allows a thinner blanket and shield. In addition, the high current density in the plasma allows ohmic heating to ignition, eliminating the need for auxiliary heating equipment. The RFP confinement concept allows arbitrary aspect ratios, and the circular cross sections of plasma eliminates the need for plasma shaping coils, Lastly, the higher plasma densities particularly at the edge, together with operation with a highly radiative RFP plasma, significantly reduce the divertor heat flux and erosion problems. In this section, the theoretical principles and understanding of the RFP confinement scheme are described, emphasizing those features that are relevant to a fusion reactor.

20465 (UCLA/PPG–1200-Vol.2, pp. 3.1-3.68) **Parametric systems studies and design-point selection.** Miller, R.L. (Los Alamos National Lab., NM (United States)); Krakowski, R.A. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

The objective of the systems analysis activity is the systematic study and determination of plant operating parameters through economic analysis and optimization of the power station, emphasizing the performance of the fusion power core. The fusion power core (FPC) includes the plasma chamber, first wall, blanket, shield, coils, and associated structure. The reference design points are chosen to meet overall design goals of the TITAN study such as minimal cost of electricity (COE) and high mass power density (MPD). In addition to the reference design points, trade-off and sensitivity studies were performed to establish and characterize the design window for attractive RFP reactor operation. A parametric systems analysis (PSA) computer code is used for this study. This code was originally developed for use in the Los Alamos compact reversed-field pinch reactor (CRFPR) studied, and the cost data base was updated in the course of the Los Alamos modular stellarator reactor, MSR and spherical torus reactor, ATR/ST studies. Code models include steady-state surveys designed to assess sensitivities and trade-offs related to various TITAN operating configurations and assumptions. These models are benchmarked and calibrated against more detailed plasma physics and magnetics models to provide a framework for the overall design process.

20466 (UCLA/PPG–1200-Vol.2, pp. 4.1-4.64) **Magnetics.** Bathke, C.G. (Los Alamos National Lab., NM (United States)); Duggan, W.P.; Kelleher, W.P.; Steiner, D.; Najmabadi, F. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

The design points for the TITAN reversed-field-pinch (RFP) reactors were generated with the parametric systems model. The parametric systems analysis (PSA) model uses a simplified description of the magnet configuration to estimate the magnet performance as characterized by the coil positions, masses and ohmic losses. To advance the reactor design from the PSA level, the magnet design must be considered in more detail using the models described here. The magnet configuration consists of the following sets of coils: toroidal-field (TF), divertor-field (DF), and poloidal-field (PF) coils. The TITAN reactors operate at steady state using the oscillating-field current-drive (OFCD) system. Rather than using a separate coil set to sustain the toroidal plasma current of $I_\phi \simeq$ 18 MA, the TF, DF, and PF coils are oscillated about their steady-state currents and used as the OFCD driver coils. In addition, the TF coils provide the initial bias field, $B_{\phi o}$, on which the initial RFP configuration is formed. These coils subsequently maintain the external reversed field, $B_{\phi R}$, with a minimum ripple, $\Delta B_R/B_\phi$, at the plasma edge.

20467 (UCLA/PPG–1200-Vol.2, pp. 6.1-6.66) **Plasma transient operations.** Najmabadi, F. (Univ. of California, Los Angeles (United States)); Yuhyi Chu; Bathke, C.G.; Krakowski, R.A.; Miller, R.L. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

A typical reversed-field-pinch (RFP) experimental discharge can be divided into four phases: (1) breakdown and formation, (2) current ramp-up, (3) sustainment, and (4) termination. Ignition and fusion burn in a reactor are achieved during the current ramp-up phase, and operation of the current-drive system is required during the sustainment phase. The breakdown and formation phase encompasses the time from the start, which begins by establishing a toroidal magnetic field inside the discharge chamber in the absence of the plasma, to the formation of a seed RFP plasma. At the time of peak toroidal magnetic field, poloidal-field windings are activated to produce a flux change through the center of the torus and, consequently, a toroidal voltage around the discharge chamber. This voltage typically ionizes the gas in few microseconds and the toroidal current is initiated in the resulting plasma. The toroidal plasma current and the toroidal magnetic field within the plasma increase while the toroidal magnetic field a the wall decreases, keeping the average toroidal field (and the toroidal flux) in the chamber almost constant. Eventually the toroidal magnetic field at the wall changes sign and is crowbarred in the reverse direction relative to the back-biased condition of the breakdown and formation phase. This paper reviews the existing RPF experimental data base for RFP formation and start-up, which is then applied to the TITAN designs. The ignition requirements for ohmically heated RFPs are studied in order to identify the optimum path for TITAN start-up. Using the TITAN seed RFP conditions, a 0-D, profile-averaged plasma-circuit code is used to simulate the evolution of the TITAN plasma through current ramp, ignition, and burn transients.

20468 (UCLA/PPG–1200-Vol.2, pp. 8.1-8.56) **Physics issues for compact reversed-field-pinch reactors.** Krakowski, R.A. (Los Alamos National Lab., NM (United States)); Najmabadi, F. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 2, TITAN plasma engineering.* 431p. Order Number DE92000140. Source: OSTI; NTIS; INIS.

The performance projected for the TITAN reactor designs depends crucially on the physics areas described in this paper. Given below are the key physics issues for the high-power-density RFP reactors and recommendations to the RFP experimental physics program. (1) Confinement: Determine spatially resolved profiles in non-transitory RFPs in order to resolve the scaling of intrinsic energy confinement time with plasma geometry, current or current density, and F-Θ value in hot plasmas with low values of $\xi = \upsilon_D/\upsilon_{THe}$ and Z_{eff}. (2) Current drive: Investigate both DC and AC techniques for helicity injection in hot RFPs with separatrices and minimal modulation-induced plasma-wall interaction. Other means of current drive should also be investigated. (3) Impurity control: Emphasize plasma operation with a toroidal-field separatrix in order to minimize plasma-wall interaction in a highly radiating plasma, eventually leading to high-recycling divertor operation and an easing of OFCD with a fixed separatrix position. (4) Formation and start-up: Clearly resolve the scaling of plasma resistance with current ramp rate, current, geometry, and F-Θ values in plasmas with low values of electron streaming parameters, and minimal and/or controllable plasma-wall interactions. Finally, current termination is a safety and economics concern because of the large magnetic stored energy in the TITAN plasma. Experimental techniques for control of current termination and plasma shutdown, leading to a soft-landing, especially by passive means, are essential for achieving a high degree of safety and environmental attractiveness for RFP reactors.

20469 (UCLA/PPG–1200-Vol.3, pp. 10.1-10.154) **TITAN-I fusion-power-core engineering.** Grotz, S.P. (Univ. of California, Los Angeles (United States)); Blanchard, J.P.; Cooke, P.I.H.;

Ghoniem, N.M.; Hasan, M.Z.; Martin, R.C.; Najmabadi, F.; Orient, G.O.; Schultz, K.R.; Sharafat, S.; Cheng, E.T.; Creedon, R.L.; Wong, C.P.C.; Krakowski, R.A.; DCalifornia Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Final report, 1990: Volume 3, TITAN-1 fusion power core.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

The TITAN-I reactor is a compact, high-neutron-wall-loading (18 MW/m^2) design. The TITAN-I fusion power core (FPC) is cooled by liquid lithium and uses a vanadium alloy (V-3Ti-1Si) as the structural material. In this section, the detailed engineering design and analysis of the TITAN-I FPC is presented. The FPC components considered here are the reactor torus (including the first wall, blanket, and divertor), hot shielded, and coil sets. The areas of materials, neutronics, thermal and structural design, magnet engineering, and power-cycle analysis are discussed. The emphasis of the TITAN study has been on the investigation and demonstration of the feasibility of the compact, high-power-density reactors and also identification of the critical issues for these devices. Therefore, some of the engineering issues that were not considered crucial to the design were for the most part not covered in detail in this study.

20470 (UCLA/PPG–1200-Vol.3, pp. 11.1-11.45) **TITAN-I divertor engineering.** Cooke, P.I.H. (Univ. of California, Los Angeles (United States)); Blanchard, J.P.; Grotz, S.P.; Hasan, M.Z.; Orient, G.E.; Sharafat, S.; Bathke, C.C.; Cheng, E.T.; Creedon, R.L.; Duggan, W.P. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 3, TITAN-I fusion power core: Final report.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

This section describes the engineering design of the divertor of the TITAN-I, including the thermal and mechanical design of the divertor components, materials selection, and fabrication issues. Toroidal-field divertors are selected as the impurity-control and particle-exhaust system of TITAN reactors. The design of the impurity-control system poses some of the most severe problems of any component of a DT fusion reactor. For TITAN the divertor design probably represents the most critical engineering and physics issue for the reactor. The two main design issues for the divertor system are to achieve heat loadings on the divertor collector plate (or target) that do not exceed the maximum acceptable level, while simultaneously ensuring that the sputtering erosion rate does not lead to an early failure of the component. These two aims tend to conflict, because the high heat loadings which inevitably occur on the divertor target require the use of thin structures to minimize temperature differences and thermal stresses, while a thick structure is necessary to give a long life against erosion.

20471 (UCLA/PPG–1200-Vol.3, pp. 12.1-12.29) **TITAN-I tritium systems.** Daikai Sze (Argonne National Lab., IL (United States)); Bartlit, J.R.; Martin, R.C. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 3, TITAN-I fusion power core: Final report.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

The major units in the tritium system of a fusion reactor are: (1) the blanket tritium-recovery system, (2) plasma-exhaust processing system, (3) the fuel-processing and safety systems. The complete tritium system has to be designed under the constraints of tritium inventory, system cost, and tritium leakage rate. Significant relaxation of any one of the constraints will have a major impact on the overall design of the complete system. The blanket tritium systems are discussed, including estimates of tritium diffusion and inventory in the fusion power core (FPC) and the description of the molten-salt recovery system chosen for the TITAN-I design. Fuel-processing and tritium-cleanup and safety-related systems are discussed. Results and conclusion are summarized.

20472 (UCLA/PPG–1200-Vol.3, pp. 13.1-13.50) **TITAN-I safety design and radioactive-waste disposal.** Wong, C.P.C. (General Atomics, San Diego, CA (United States)); Cheng, E.T.; Creedon, R.L.; Hoot, C.G.; Schultz, K.R.; Grotz, S.P.; Blanchard, J.P.; Conn, R.W.; Najmabadi, F.; Sharafat, S. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 3, TITAN-I fusion power core: Final report.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

Strong emphasis has been given to safety engineering in the TITAN study. Instead of add-on safety design and analysis task, the safety activity was incorporated into the process of design selection and integration at the beginning of the study. The safety-design objectives of the TITAN-I design are: (1) to satisfy all safety-design criteria as specified by the Nuclear Regulatory Commission on accidental releases, occupational doses, and routine effluents and (2) to aim for the best possible level of passive safety assurance. The safety design and evaluations of the TITAN-I reactor are presented. The safety design goals for the TITAN reactors are discussed and the safety-design features are reviewed. Safety analyses for the TITAN-I design are reported for loss-of-flow and loss-of-coolant accidents in the fusion power core, for lithium fires, and for plasma-related accidents. The radioactive-waste-disposal issues and ratings for the TITAN-I design are described. A summary of the TITAN-I safety design and analysis is given.

20473 (UCLA/PPG–1200-Vol.3, pp. 14.1-14.16) **TITAN-I maintenance procedures.** Grotz, S.P. (Univ. of California, Los Angeles (United States)); Cooke, P.I.H.; Najmabadi, F.; Creedon, R.L.; Wong, C.P.C.; Duggan, W.P.; Krakowski, R.A. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 3, TITAN-I fusion power core: Final report.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

The TITAN reactors are compact, high-power-density designs. The small physical size of these reactors permits each design to be made of only a few pieces, allowing a single-piece maintenance approach. Single-piece maintenance refers to a procedure in which all components that must be changed during the scheduled maintenance are replaced as a single unit, although the actual maintenance procedure may involve the movement, storage, and reinstallation of some other reactor components. In TITAN designs, the entire reactor torus is replaced as a single unit during scheduled maintenance. Furthermore, because of the small physical size and mass of the TITAN-I FPC, the maintenance procedures can be carried out through vertical lifts, allowing a much smaller reactor vault. The advantage of using fully toroidal units with vertical lifts for maintenance has been verified in some fusion experiments. In this section, the layout of the main power-plant buildings and the proposed maintenance procedures for the TITAN-I reactor are presented. A comparison of the TITAN-I single-piece maintenance procedure with a modular approach is difficult. Therefore, only those steps that are likely to be different between single-piece and modular approaches have been identified. Pretesting of the reactor torus to full operating condition is one of the potential advantages of the TITAN-I single-piece approach and is discussed.

20474 (UCLA/PPG–1200-Vol.3, pp. 9.1-9.64) **Overview of TITAN-I design.** Najmabadi, F. (Univ. of California, Los Angeles (United States)); Grotz, S.P.; Wong, C.P.C. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 3, TITAN-I fusion power core: Final report.* 403p. Order Number DE92000139. Source: OSTI; NTIS; INIS.

The key engineering issues for the TITAN-I FPC are discussed. In the area of materials, more data on irradiation behavior of V-3Ti-1Si, especially irradiation-induced swelling, are needed to confirm the materials prediction and to estimate accurately the lifetime of the TITAN-I first wall Further creep-rupture experiments are also needed to develop more precise creep-rupture models for V-3Ti-1Si. The low value of the toroidal field in the RFP allows high coolant velocities to be achieved without prohibitive MHD pressure drops, thus permitting operation in the turbulent-flow regime, with the associated high heat-transfer coefficients. Further experimental data on turbulent-flow heat-transfer capability of liquid metals, especially in the TITAN-relevant operational regime of low magnetic field and high velocities, are crucial to verify the TITAN-I thermal-hydraulic design. The TITAN-I poloidal-field-coil system requires little or no extrapolation of current technology. But, the TITAN-I TF and divertor IBC design encounters several critical engineering issues. The design of the impurity-control system poses some of the most severe problems of any component of a DT fusion reactor, and for a compact or high-power-density design these problems can be particularly challenging. The TITAN-I molten-salt tritium-recovery process needs large-scale demonstration. Any fusion reactor with vanadium first walls may encounter the problem of plasma-driven permeation (PDP) of tritium. The extent of PDP should be experimentally investigated. The TITAN-I design uses many safety-design features to achieve a high level of safety assurance.

20475 (UCLA/PPG–1200-Vol.4, pp. 15.1-15.60) **Overview of TITAN-II design.** Najmabadi, F. (Univ. of California, Los Angeles (United States)); Grotz, S.P.; Wong, C.P.C. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

The TITAN research program is a multi-institutional effort to determine the potential of the reversed-field-pinch (RFP) magnetic fusion concept as a compact, high-power-density, and attractive fusion energy system from economics (cost of electricity, COE), safety, environmental, and operational viewpoints. In recent reactor studies, the compact reactor option has been identified as one approach toward a more affordable and competitive fusion reactor. The main feature of a compact reactor is a fusion power core (FPC) with a mass power density in excess of 100 to 200 kWe/tone. Mass power density (MPD) is defined as the ratio of the net electric power to the mass of the FPC, which includes the plasma chamber, first wall, blanket, shield, magnets, and related structure. To achieve the design objectives of the TITAN study, the program was divided into two phases, each roughly one year in length: the Scoping Phase and the Design Phase. The Design Phase focused on the conceptual engineering design of basic ideas developed during the Scoping Phase with direct input from the parametric systems analysis and with strong emphasis on safety, environmental, and operational (maintenance) issues. Four candidate TITAN FPCs were identified during the Scoping Phase. The lithium-loop design promises excellent thermal performance and is one of the main concepts being developed by the blanket technology program. The water-cooled design promises excellent safety features and uses more developed technologies. The helium-cooled ceramic design offers true inherent safety and excellent thermal performance. The lithium-loop (TITAN-I) and the aqueous loop-in-pool (TITAN-II) concepts were chosen for detailed conceptual design and evaluation in the Design Phase. The choice was based primarily on the capability to operate at high neutron wall load and high surface heat flux.

20476 (UCLA/PPG–1200-Vol.4, pp. 16.1-16.143) **TITAN-II fusion-power-core engineering.** Wong, C.P.C. (General Atomics, San Diego, CA (United States)); Cheng, E.T.; Creedon, R.L.; Schultz, K.R.; Blanchard, J.P.; Cooke, P.I.H.; Ghoniem, N.M.; Grotz, S.P.; Hasan, M.Z.; Martin, R.C.; Najmabadi, F.; Sharafat, S.; Steiner, D.; Daikai Sze; GierszewsCalifornia Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

The TITAN-II reactor is a compact, high-neutron-wall-loading (18 MW/m^2) design. The TITAN-II fusion power core (FPC) is cooled by an aqueous lithium-salt solution which also acts as the breeder material. The major feature of the TITAN-II reactor is that the entire primary loop is located at the bottom of a low-temperature, atmospheric-pressure, pure-water pool. Detailed safety analyses shows that the TITAN-II pool can contain the afterheat energy of the FPC and will remain at a low enough temperature so that tritium or other radioactive material in the primary-coolant system will not be released. In this section, the detailed engineering design and analysis of the TITAN-II FPC is presented. The FPC components considered here are the first wall, blanket, shield, and the coil sets. The use of an aqueous solution imposes special constraints on the selection of breeder and structural material because of the corrosion concerns, hydrogen embrittlement and radiolytic effects.

20477 (UCLA/PPG–1200-Vol.4, pp. 17.1-17.30) **TITAN-II divertor engineering.** Cooke, P.I.H. (Univ. of California, Los Angeles (United States)); Blanchard, J.P.; Grotz, S.P.; Hasan, M.Z.; Sharafat, S.; Bathke, C.C.; Creedon, R.L. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

This section describes the engineering design of the divertor of TITAN-II, including the thermal and mechanical design of the divertor components, materials selection, and fabrication issues. The design of the impurity-control system poses some of the most severe problems of any component of a DT fusion reactor. For TITAN, the divertor design represents the most critical engineering and physics issues for the reactor. The two main design issues for the divertor system are to achieve heat loadings on the divertor collector plate (or target) that do not exceed the maximum acceptable level, while simultaneously ensuring that the sputtering erosion rate does not lead to an early failure of the component. These two aims tend to conflict, because the high heat loadings which inevitably occur on the divertor target require the use of thin structures to minimize temperature differences and thermal stresses, while a thick structure is necessary to give a long life against erosion.

20478 (UCLA/PPG–1200-Vol.4, pp. 18.1-18.28) **TITAN-II tritium systems.** Daikai Sze (Argonne National Lab., IL (United States)); Bartlit, J.R.; Martin, R.C.; Gierszewski, P.J.; Kevton, O.K. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

In this section, specific tritium-system design issues that relate to the use of the aqueous-salt blanket coolant in TITAN-II are considered. A critical issue is the need to recover and control tritium that is bred directly in the water coolant of the primary heat-transport system. In particular, tritium recovery from water is required on a scale larger than existing water-detritiation systems. However, there is considerable industrial experience with recovery of hydrogen and its isotopes from water, and some relevant processes equipment is used on larger scale in non-tritium applications. The TITAN-II design considers higher tritium levels (50 Ci/kg) in the primary-coolant water relative to previous design studies in order to minimize the cost of water-processing equipment required for tritium recovery. Design features which make this possible are: (1) lower pressure in the primary system resulting from an elevation of the fluid boiling point caused by the addition of the Li salt, (2) possible use of double-walled steam generators, (3) presence of the water pool which captures a large part of the tritiated-water leakage, (4) routine use of welded joints, and (5) removal of tritiated water to safe storage during major maintenance operations. Components leakage rates and air-drier technology are based on CANDU systems performance. The overall tritium-loss rate for the TITAN-II design is estimated at 50 Ci/d. The analysis of the TITAN-II tritium systems is given in the subsequent sections. The tritium flow rates are estimated. The blanket tritium-recovery system, the plasma-exhaust-purification system, and the room-air-cleanup system are discussed.

20479 (UCLA/PPG–1200-Vol.4, pp. 19.1-19.31) **TITAN-II safety design and radioactive-waste disposal.** Wong, C.P.C. (General Atomics, San Diego, CA (United States)); Cheng, E.T.; Schultz, K.R.; Grotz, S.P.; Sharafat, S. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

Strong emphasis has been given to safety engineering in the TITAN study. Instead of an add-on safety design and analysis task, the safety activity was incorporated into the process of design selection and integration at the beginning of the study. The safety-design objectives of the TITAN-II design are: (1) to satisfy all safety-design criteria as specified by the Nuclear Regulatory Commission on accidental releases, occupational doses, and routine effluents and (2) to aim for the best possible level of passive safety assurance. The safety design and evaluations of the TITAN-II reactor are presented. The safety-design goals for the TITAN reactors are discussed. To achieve a high level of safety assurance, the TITAN-II fusion power core (FPC) is submerged in a pool of low-temperature, low-pressure water. Various safety scenarios and the impact of the water pool are reviewed. Detailed analyses of loss-of-flow and loss-of-coolant accidents in the TITAN-II FPC are reported. Plasma-related accidents and plasma shutdown methods for TITAN-II are similar to those of TITAN-I (Section 13.6) and thus are not repeated here. The radioactive waste-disposal issues and ratings for the TITAN-II design are discussed. A summary of the TITAN-II safety design and analysis is given.

20480 (UCLA/PPG–1200-Vol.4, pp. 20.1-20.14) **TITAN-II maintenance procedures.** Grotz, S.P. (Univ. of California, Los Angeles (United States)); Cooke, P.I.H.; Najmabadi, F.; Creedon, R.L.; Wong, C.P.C.; Krakowski, R.A. California Univ., Los Angeles, CA (United States); General Atomics, San Diego, CA (United States); Los Alamos National Lab., NM (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering. 1990. In *The TITAN reversed-field-pinch fusion reactor study. Volume 4, TITAN-2 fusion power core: Final report.* 349p. Order Number DE92000138. Source: OSTI; NTIS; INIS.

The TITAN reactors are compact, high-power-density designs. The small physical size of these reactors permits each design to be made of only a few pieces, allowing a single-piece maintenance approach. Single-piece maintenance refers to a procedure in which all of components that must be changed during the scheduled maintenance are replaced as a single unit, although the actual maintenance procedure may involve the movement, storage, and reinstallation of some other reactor components. In TITAN designs, the entire reactor torus is replaced as a single unit during scheduled maintenance. Furthermore, because of the small physical size and mass of the TITAN-II FPC, the maintenance procedures can be carried out through vertical lifts, allowing a much smaller reactor vault. The advantage of using fully toroidal units with vertical lifts for maintenance has been verified in some fusion experiments. In this section, the layout of the main power-plant buildings and the proposed maintenance procedures for the TITAN-II reactor are presented. A comparison of the TITAN-II single-piece maintenance procedure with a modular approach is difficult because: (1) the TITAN-II fusion power core (FPC) is designed so that the advantages of a single-piece approach are fully utilized and a different design should have been produced to compare and quantify the benefits of single-piece maintenance procedures, (2) little data is available on times that would be required for each step during the maintenance procedure, and (3) data are needed on mean time-to-failure and mean time-to-repair of various components in order to quantify the impact of the maintenance procedure on the overall plant availability. Therefore, only those steps that are likely to be different between single-piece and modular approaches have been identified. Pretesting of the reactor torus to full operating condition is one of the potential advantages of the TITAN-I and TITAN-II single-piece approach.

20481 (UCRL-CR–104380-Rev.1) **Tunable driver for the LLNL FEL experiment: Final report, [1 June 1990–1 June 1991]: Revision 1.** Guss, W.C. (Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center); Basten, M.A.; Kreischer, K.E.; Temkin, R.J. Lawrence Livermore National Lab., CA (United States); Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. Jul 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011292. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes main activities undertaken during the period 1 June 1990 to 1 June 1991 by MIT to support the Lawrence Livermore National Laboratory tunable FEL driver project. The goal of this research was to further characterize a tunable microwave source (already identified as a BWO-gyrotron) of moderate output power (10–20 kW). In the 1989 fiscal year, the source was assembled at MIT and initial tests were conducted. Proposed for the fiscal year 1990 were analysis of the previous experimental results, and the performance of new experiments designed to increase the voltage tuning range, the output efficiency, and magnetic field tuning. During the report period the previous experimental results were analyzed and compared to computational results and new components were designed, to make the BWO ready for further experiments. In addition, the BWO-gyrotron was mounted in a new superconducting magnet and initial magnetic field profile measurements were made.

20482 (UCRL-CR–109550) **Blast venting through blanket material in the HYLIFE ICF reactor.** Liu, J.C. (California Univ., Berkeley, CA (United States). Dept. of Nuclear Engineering); Peterson, P.F.; Schrock, V.E. Lawrence Livermore National Lab., CA (United States); California Univ., Berkeley, CA (United States). Dept. of Nuclear Engineering. 10 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–11: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92011967. Source: OSTI; NTIS; INIS; GPO Dep.

This work presents a numerical study of blast venting through various blanket configurations in the HYLIFE ICF reactor design. The study uses TSUNAMI – a multi-dimensional, high-resolution, shock capturing code – to predict the momentum exchange and gas dynamics for blast venting in complex geometries. In addition, the study presents conservative predictions of wall loading by gas shock and impulse delivered to the protective liquid blanket. Configurations used in the study include both 2700 MJ and 350 MJ fusion yields per pulse for 5 meter and 3 meter radius reactor chambers. For the former, an annular jet array is used for the blanket geometry, while in the latter, both annular jet array as well as slab geometries are used. Results of the study indicate that blast venting and wall loading may be manageable in the HYLIFE-II design by a judicious choice of blanket configuration.

20483 (UCRL-CR–109602) **Toroidal field coil replacement study for the International Thermonuclear Experimental Reactor (ITER).** Lawrence Livermore National Lab., CA (United States); Bechtel Corp., San Francisco, CA (United States). Aug 1991. 251p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (ITER/US–91/EN-ME-1). Order Number DE92013010. Source: OSTI; NTIS; GPO Dep.

The objective of this study is to develop an estimate of the time required to replace a failed toroidal field (TF) coil in the International Thermonuclear Experimental Reactor (ITER). This estimate is based on the current ITER design which resulted from the Conceptual Design Activities began in spring of 1988 and ending in December 1990. Although the TF Coils in ITER are designated permanent components and expected to last the life of the plant, the history of failures of large coils in fusion devices has prompted an assessment of the down time that might be required for replacement of a failed TF coil in ITER. The difficulty of replacement of a TF Coil in ITER is compounded by the large physical size of ITER, and the radiation fields which necessitate the use of remote handling equipment for most maintenance activities. Since 10 out of of 16 TF coils are adjacent to either a Neutral Beam Injector (NBI) port or a remote handling (RH) port, it is probable that a failed TF Coil will be in one of these inconvenient locations. For this study, TF coil number 3 is assumed to fail and its replacement will be evaluated as a typical case. TF coil number 3 is located between a remote handling port (#3) and a port allocated to the lower hybrid (#4).

20484 (UCRL-JC–104099) **Electron accelerators with pulsed power drives.** Barletta, W.A. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 8 Jun 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-900603–65: EPAC '90: 2nd European particle accelerator conference ACROPOLIS, Nice (France), 11-16 Jun 1990). Order Number DE92011524. Source: OSTI; NTIS; GPO Dep.

Pulsed power driven accelerators can produce intense beams with diverse characteristics, ranging from extremely high peak power at low repetition rate to high average power with moderate beam current. The continuing development of highly reliable components for linear induction accelerators (LIAs) and free electron lasers (FELs) may enable one to use such accelerators as economical sources of microwave power to drive magnetic fusion reactors and high-gradient rf linacs. More recently, the technology of pulsed power driven accelerators has been extended to allow the acceleration of intense pulses with <5-ns duration.

20485 (UCRL-JC–106802) **Atomic processes, cross sections, and reaction rates necessary for modelling hydrogen-negative-ion sources and identification of optimum H^- current densities.** Hiskes, J.R. Lawrence Livermore National Lab., CA (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-910943–5: 4. international conference on ion sources, Bensheim (Germany), 30 Sep - 4 oct 1991). Order Number DE92010438. Source: OSTI; NTIS; INIS; GPO Dep.

The principal electron excitation cross sections for vibrational excitation in a hydrogen discharge are reported. In the first chamber of a two-chamber hydrogen negative-ion-source system subject to the beam-line constraint of a maximum gas pressure, the density of vibrationally excited molecules reaches an asymptote for increasing discharge current or the equivalent fast electron density. Operating near this first-chamber asymptote, there exists a spatially-dependent maximum negative-ion density in the second chamber. With the extraction grid placed at this maximum the optimum performance of a hydrogen-based system is determined. This optimum performance provides a criterion for the selection of differing source types for fusion applications.

20486 (UCRL-JC–109337) **Numerical simulation of the stability in long cable-in-conduit conductors for fusion magnets.** Yeaw, C.T. (Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics); Wong, R.L. Lawrence Livermore National Lab., CA (United States). 5 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–13: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92012694. Source: OSTI; NTIS; INIS; GPO Dep.

The stability phenomenon is investigated numerically for a quench initiating in a cable-in-conduit conductor (CICC) at a significant distance from the ends. The thermo-hydraulic computer program, CICC, was used. The geometry chosen for this study is a toroidal field (TF) coil for the conceptual design activity (CDA) of the International Thermonuclear Experimental Reactor (ITER). Previous studies of short conductors have shown that convective helium flows, induced by the initiating heat pulse, control the stability of the conductor. The present study of a long conductor exhibits reduced energy margins and the absence of a transition region between the well-cooled and ill-cooled stability regions because the initiating heat pulse has difficulty sustaining a convective flow. The effect of heat-pulse duration and heated length were considered. For short, high-energy heat pulses, high convective and conductive heat-transfer coefficients can only be mismatched for 10 ms. If the heat-pulse energy is spread your 100 ms, the steady-state heat-transfer coefficient is sufficient to stabilize the conductor. Pulse durations between 10 and 100 ms cause a decrease in energy margin. On the other hand, the conductor length heated was found to have only a small effect on stability. 3 refs.

20487 (UCRL-JC–109517) **Low cost, high yield IFE reactors: Revisiting Velikhov's vaporizing blankets.** Logan, B.G. Lawrence Livermore National Lab., CA (United States). 6 Mar 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920606–16: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92011964. Source: OSTI; NTIS; INIS; GPO Dep.

The performance (efficiency and cost) of IFE reactors using MHD conversion is explored for target blanket shells of various materials vaporized and ionized by high fusion yields (5 to 500 GJ). A magnetized, prestressed reactor chamber concept is modeled together with previously developed models for the Compact Fusion Advanced Rankine II (CFARII) MHD Balance-of-Plant (BoP). Using conservative 1-D neutronics models, high fusion yields (20 to 80 GJ) are found necessary to heat Flibe, lithium, and lead-lithium blankets to MHD plasma temperatures, at initial solid thicknesses sufficient to capture most of the fusion yield. Advanced drivers/targets would need to be developed to achieve a "Bang per Buck" figure-of-merit $\gtrsim$ 20 to 40 joules yield per driver $ for this scheme to be competitive with these blanket materials. Alternatively, more realistic neutronics models and better materials such as lithium hydride may lower the minimum required yields substantially. The very low CFARII BoP costs (contributing only 3 mills/kWehr to CoE) allows this type of reactor, given sufficient advances that non-driver costs dominate, to ultimately produce electricity at a much lower cost than any current nuclear plant.

20488 (UCRL-JC–109522) **HYLIFE-II inertial fusion energy power plant design.** Moir, R.W. Lawrence Livermore National Lab., CA (United States). 5 Mar 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–10: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92011965. Source: OSTI; NTIS; INIS; GPO Dep.

The HYLIFE-II inertial fusion power plant design study uses a liquid fall, in the form of jets, to protect the first structural wall from neutron damage, x rays, and blast to provide a 30-y lifetime. HYLIFE-I used liquid lithium. HYLIFE-II avoids the fire hazard of lithium by using a molten salt composed of fluorine, lithium, and beryllium (Li_2BeF_4) called Flibe. Access for heavy-ion beams is provided. Calculations for assumed heavy-ion beam performance show a nominal gain of 70 at 5 MJ producing 350 MJ, about 5.2 times less yield than the 1.8 GJ from a driver energy of 4.5 MJ with gain of 400 for HYLIFE-I. The nominal 1 GWe of power can be maintained by increasing the repetition rate by a factor of about 5.2, from 1.5 to 8 Hz. A higher repetition rate requires faster re-establishment of the jets after a shot, which can be accomplished in part by decreasing the jet fall height and increasing the jet flow velocity. In addition, although not adequately considered for HYLIFE-I, there is liquid splash that must be forcibly cleared because gravity is too slow, at higher repetition rates than 1 Hz. Splash removal is accomplished in the central region by oscillating jet flows. The cost of electricity is estimated to be 0.09 $/kW·h in constant 1988 dollars, about twice that of future coal and light water reactor nuclear power. The driver beam cost is about one-half the total cost, that is, a zero cost driver would give a calculated cost of electricity of 0.045 $/kWh.

20489 (UCRL-JC–109608) **A comparison of results from an edge-plasma model with those from a two-dimensional fluid code.** Barr, W.L. (Lawrence Livermore National Lab., CA (United States)); Bulmer, R.H.; Perkins, L.J.; Cohen, S.A.; Werley, K.A. Lawrence Livermore National Lab., CA (United States). 3 Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–6: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92010718. Source: OSTI; NTIS; INIS; GPO Dep.

We have just completed a comparison of predictions for the scrape-off layer (SOL) plasma, from a physics model with the more accurate ones from a two-dimensional fluid code, the B2 code. The results presented here show rather good agreement on values of plasma temperature in the SOL and of divertor heat load, for a rather wide range of Tokamak sizes and parameters. We are therefore confident that this model will provide a suitable divertor module for both the new ITER systems code, SUPERCODE, and other applications requiring fast but accurate modelling of edge plasma parameters at least within the range of the present benchmarks.

20490 (UCRL-JC–109811) **A "SuperCode" for performing systems analysis of tokamak experiments and reactors.** Haney, S.W. (Lawrence Livermore National Lab., CA (United States)); Barr, W.L.; Crotinger, J.A.; Perkins, L.J.; Solomon, C.J.; Chaniotakis, E.A.; Freidberg, J.P.; Wei, J.; Galambos, J.D.; Mandrekas, J. Lawrence Livermore National Lab., CA (United States). 4 Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–7: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92010719. Source: OSTI; NTIS; INIS; GPO Dep.

A new code, named the "SUPERCODE," has been developed to fill the gap between currently available zero dimensional systems codes and highly sophisticated, multidimensional plasma performance codes. The former are comprehensive in content, fast to execute, but rather simple in terms of the accuracy of the physics and engineering models. The latter contain state-of-the-art plasma physics modelling but are limited in engineering content and time consuming to run. The SUPERCODE upgrades the reliability and accuracy of systems codes by calculating the self consistent 1 1/2 dimensional MHD-transport plasma evolution in a realistic engineering environment. By a combination of variational techniques and careful formation, there is only a modest increase in CPU time over O-D runs, thereby making the SUPERCODE suitable for use as a systems studies tool. In addition, considerable effort has been expended to make the code user- and programming-friendly, as well as operationally flexible, with the hope of encouraging wide usage throughout the fusion community.

20491 (UCRL-JC–109816) **Status and plans for US ITER studies.** Doggett, J.N. Lawrence Livermore National Lab., CA (United States). 6 Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920607–12: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92011944. Source: OSTI; NTIS; INIS; GPO Dep.

The United States' participation in the International Thermonuclear Experimental Reactor (ITER) began in later 1987 when the initiative to start a cooperative program among the four Parties – the Soviet Union, Japan, the European Community, and the United States – was initiated. Participation then continued through the start of Joint Work in May 1988 until the conclusion of the Conceptual Design Activities (CDA) in December 1990. In the period between the conclusion of the CDA and the agreement to execute the Engineering Design Activities (EDA), the US ITER Home Team continued to do work on the design, executed additional research and development, and participated in the preparations for the EDA. Activities included one major design study on a High-Aspect-Ratio Design and input to the National ITER Technical Review, the ITER Steering Committee – US, Special Working Group 1, and the Fusion Energy Advisory Committee's Panel 1. Research and development was continued in areas of work that were identified as critical-path elements by an international panel chartered by the four ITER Parties near the end of the CDA. I will describe the conclusion of the CDA and the interim US ITER activities and will give an indication of our involvement in the EDA.

99 GENERAL AND MISCELLANEOUS

20492 (CONF-9110367–Summ.) **Sharing our successes: Changing the face of science and mathematics education through teacher-focused partnerships.** Babcock, C. (ed.). California Univ., Berkeley, CA (United States). [1991]. 57p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States); National Science Foundation, Washington, DC (United States); California Univ., Berkeley, CA (United States); Triangle Coalit DOE Contract AC03-76SF00098. From Changing the face of science and mathematics education through teacher-focused partnerships: sharing our success; Berkeley, CA (United States); 2-4 Oct 1991. Order Number DE92011884. Source: OSTI; NTIS; GPO Dep.

The Industry Initiatives for Science and Math Education (IISME) program, founded six years ago, is among those of which we are most proud, because of its success. IISME has identified 70 different scientific work experience programs for science and math teachers in 31 states and the District of Columbia. Approximately 45 of the IISME programs in this country are industry-based; 21 are part of the DOE-sponsored Teacher Research Associate (TRAC) Program; the remainder are university-based. Of the 70 known programs nationwide, nearly 40 are represented here today. Teachers work side by side with an industry mentor, then return to the classroom with renewed enthusiasm, firsthand experience with new technologies, and an improved understanding of industry's workforce needs and information about science careers to share with their students. This conference provided a forum for the interaction of K–12 teachers for information sharing about their programs of alliances and their plans to improve science education.

20493 (NEA/NEACRP/R–91-2) **Reactor physics activities in NEA member countries October 1990-September 1991.** Nuclear Energy Agency, 75 - Paris (France). 1991. 162p. Order Number DE92517872. Source: OSTI; NTIS (US Sales Only); INIS.

This document is a compilation of National Activity Reports presented at the Thirty-Fourth Meeting of the NEA Committee on Reactor Physics, held at the Paul Scherrer Institute, Wuerenlingen, Switzerland, from 3rd-5th September 1991.

9901 Management

Refer also to citation(s) 17893, 17939, 17989, 18003, 18005, 18106, 18318, 18360, 18542, 18632, 18796, 19153, 19154, 19155, 20626

20494 (AECL–10196) **Progress report - physics and health sciences - physics section 1990 January 01 - June 30.** Hardy, J.C. (ed.). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Oct 1990. 182p. (PR-PHS-P–9.). Order Number DE92627151. Source: OSTI; NTIS (US Sales Only); INIS.

This is the ninth semi-annual report on the Physics section of Physics and Health Sciences. Major areas of discussion include: nuclear physics, accelerator physics, general physics, neutron's solid state physics, theoretical physics and fusion.

20495 (AECL–10332) **Progress report - physical sciences - physics division 1990 July 01 - December 31.** Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. May 1991. 119p. (PR-PHY–1.). Order Number DE92627152. Source: OSTI; NTIS (US Sales Only); INIS.

A completely new administrative structure of AECL Research was implemented on 1990 July 1. All of the basic physics programs, together with accelerator physics, radiation applications and most of the chemistry programs of AECL, have been placed in a new organizational unit called Physical Sciences. This unit also includes the management of the National Fusion Program. The research programs of Physical Sciences are grouped into three divisions: Chemistry, Physics and TASCC. Progress in each division will henceforth be reported on a twice-yearly basis. This report is the first of the new series to be issued by the Physics Division. Of special note within the period covered by this report was the successful acceleration of over 75 mA of protons to 600 keV in RFQ1 making it the highest current RFQ in the world. Our electron accelerator expertise has been recognized by the award of one of the R and D 100 awards for the IMPELA (10 MeV 50 kW) machine. Considerable activity was associated with bringing the new dual beam neutron spectrometer DUALSPEC to completion. This instrument has been jointly funded by AECL and NSERC through McMaster University and will be a central component of the national neutron scattering facility at NRU in the 1990's. A major effort was made with the writing of a Project Definition Document for installation of a cold neutron source at the most opportune time.

20496 (AECL–10420) **Progress report - physical sciences - physics division 1991 January 01 - June 30.** Atomic Energy of

Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Sep 1991. 117p. (PR-PHY-2.). Order Number DE92627153. Source: OSTI; NTIS (US Sales Only); INIS.

This is the second in the new series of reports for the Physics Division since the creation of the Physical Sciences Unit in 1990. This report has been subdivided into three self-contained sections covering the activities in the branches for Accelerator Physics, Neutron and Solid State Physics and Theoretical Physics. It is noteworthy that the RFQ1 program with the original vanes has come to a successful conclusion having accelerated 79 mA of protons to 600 keV. The new vanes to achieve a high energy of 1.2 MeV have now been installed and will form the basis for the low energy end of high current proton accelerator development. The progress in the neutron scattering program has been hampered by the NRU reactor being down for repairs since January 1991. Nevertheless a very successful opening ceremony was held to mark the completion of the new DUALSPEC spectrometers and several workshops have been held to promote the understanding of neutron scattering.

20497 (ANL/CP--75335) **A strategy for minimizing common mode human error in executing critical functions and tasks.** Beltracchi, L. (Nuclear Regulatory Commission, Washington, DC (United States)); Lindsay, R.W. Argonne National Lab., IL (United States); Nuclear Regulatory Commission, Washington, DC (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538--18: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011839. Source: OSTI; NTIS; INIS; GPO Dep.

Human error in execution of critical functions and tasks can be costly. The Three Mile Island and the Chernobyl Accidents are examples of results from human error in the nuclear industry. There are similar errors that could no doubt be cited from other industries. This paper discusses a strategy to minimize common mode human error in the execution of critical functions and tasks. The strategy consists of the use of human redundancy, and also diversity in human cognitive behavior: skill-, rule-, and knowledge-based behavior. The authors contend that the use of diversity in human cognitive behavior is possible, and it minimizes common mode error.

20498 (ANL/TM--500) **ANL site response for the DOE FY1994 information resources management long-range plan.** Boxberger, L.M. Argonne National Lab., IL (United States). Mar 1992. 180p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92012399. Source: OSTI; NTIS; GPO Dep.

Argonne National Laboratory's ANL Site Response for the DOE FY1994 Information Resources Management (IRM) Long-Range Plan (ANL/TM 500) is one of many contributions to the DOE information resources management long-range planning process and, as such, is an integral part of the DOE policy and program planning system. The Laboratory has constructed this response according to instructions in a Call issued in September 1991 by the DOE Office of IRM Policy, Plans and Oversight. As one of a continuing series, this Site Response is an update and extension of the Laboratory's previous submissions. The response contains both narrative and tabular material. It covers an eight-year period consisting of the base year (FY1991), the current year (FY1992), the budget year (FY1993), the plan year (FY1994), and the out years (FY1995-FY1998). This Site Response was compiled by Argonne National Laboratory's Computing and Telecommunications Division (CTD), which has the responsibility to provide leadership in optimizing computing and information services and disseminating computer-related technologies throughout the Laboratory. The Site Response consists of 5 parts: (1) a site overview, describes the ANL mission, overall organization structure, the strategic approach to meet information resource needs, the planning process, major issues and points of contact. (2) a software plan for DOE contractors, Part 2B, "Software Plan FMS plan for DOE organizations, (3) computing resources telecommunications, (4) telecommunications, (5) printing and publishing.

20499 (DOE/AD--0019) **Information Resources Management long-range plan: FY 1993--FY 1997.** USDOE Office of Administration and Human Resource Management, Washington, DC (United States). Office of Information Resources Management Policy, Plans, and Oversight. Feb 1992. 260p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012408. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has consolidated the Information Technology Resources (ITR) plans of its sites into a single document, the Department of Energy Information Resources Management (IRM) Long-Range Plan. This Plan is the product of a long-range planning process used to project both future information technology requirements and the resources necessary to meet those requirements. It encompasses the plans of the various organizational components within the Department and its management and operating contractors over the next 5 fiscal years (FYs), 1993 through 1997. The annual long-range planning cycle for supporting this Plan was initiated by a Call in August 1990 for site plans to be submitted in February 1991 by those Departmental components and contractors with major ITR requirements. The site plans were reviewed by the appropriate DOE Field Office, the Office of IRM Policy, Plans, and Oversight, program offices, and other senior management officials. During this review process, consideration was given to the validity of the programmatic requirements, the reasonableness of funding estimates, identification and resolution of any issues, and other alternatives available. Publication of this Plan is the culmination of the above process.

20500 (DOE/BU--0003) **Forecast of contracting opportunities, fiscal year 1992.** USDOE Office of Small and Disadvantaged Business Utilization, Washington, DC (United States). 1992. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012651. Source: OSTI; NTIS; GPO Dep.

The Forecast of Contracting Opportunities is published pursuant to Public Law 100-656, "Business Opportunity Development Reform Act of 1988." It is intended to inform shall business concerns, including those owned and controlled by socially and economically disadvantaged individuals, of the anticipated contracting and subcontracting opportunities with the US Department of Energy (DOE) and its Management and Operating contractors for Fiscal Year 1992. The Forecast will provide the small business contractor will advance notice of DOE's procurement plans as they pertain to small and small disadvantaged business concerns. Accordingly, DOE invite small business concerns to explore prime and subcontracting opportunities with headquarters and field offices, as well as with our management and operating contractors.

20501 (DOE/EH--0225P) **Organizational cultural survey of the Los Alamos Site.** USDOE, Washington, DC (United States). Nov 1991. 128p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012391. Source: OSTI; NTIS; GPO Dep.

An Organizational Survey (OS) was administered at the Los Alamos Site that queried employees on the subjects of organizational culture, various aspects of communications, employee commitment, work group cohesion, coordination of work, environmental, safety, and health concerns, hazardous nature of work, safety and overall job satisfaction. The purpose of the OS is to measure in a quantitative and objective way the notion of "culture;" that is, the values, attitudes, and beliefs of the individuals working within the organization. In addition, through the OS, a broad sample of individuals can be reached that would probably not be interviewed or observed during the course of a typical assessment. The OS also provides a descriptive profile of the organization at one point in time that can then be compared to a profile taken at a different point in time to assess changes in the culture of the organization. While comparisons among groups are made, it is not the purpose of this report to make evaluative statements of which profile may be positive or negative. However, using the data presented in this report in conjunction with other evaluative activities, may provide useful insight into the organization.

20502 (DOE/EH--0244) **Line Program Environmental Management Audit, Western Area Power Administration.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Audit. Mar 1992. 193p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012682. Source: OSTI; NTIS; GPO Dep.

On June 27, 1989, the Secretary of Energy announced a 10-point initiative to strengthen environmental protection within the US Department of Energy (DOE). Consistent with this initiative, the Secretary emphasized and strengthened independent internal oversight as a management reform in Secretary of Energy Notice (SEN)-11-89, which would monitor the effectiveness of DOE management in complying with operational, environmental, safety, health, and security standards established by law, regulation, and DOE policy. As part of the internal oversight responsibilities within DOE, the Office of Environment, Safety and Health (ES&H) has established a program within the Office of Environmental Audit, EH-24, to conduct environmental audits at DOE's operating facilities. This document contains the results of the Line Program Environmental Management Audit of the Western Area Power Administration (Western). This Line Program Environmental Management Audit was conducted by the DOE's Office of Environmental Audit between December 2 and December 18, 1991. The objective of the Audit is to advise the Secretary as to the adequacy of Western's environmental programs and management organization in ensuring environmental protection and compliance with Federal, state and DOE environmental requirements. The scope of this Line Program Environmental Management Audit was comprehensive and covered all areas of environmental management with the exception of environmental programs pertaining to the implementation of the requirements of the National Environmental Policy Act (NEPA), which is the responsibility of the DOE Headquarters Office of NEPA Oversight.

20503 (DOE/METC/C–92/7010) **Initiation of TQM at a Federal R&D Facility: Early experience.** Wilson, J.S. USDOE Morgantown Energy Technology Center, WV (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). (CONF-920310–7: American Institute of Chemical Engineers spring meeting, New Orleans, LA (United States), 29 Mar - 2 apr 1992). Order Number DE92010529. Source: OSTI; NTIS; GPO Dep.

The Morgantown Energy Technology Center (METC) is a Federal research and development laboratory that reports to the Assistant Secretary for Fossil Energy of the US Department of Energy (DOE). The laboratory has a wide-ranging mission that involves in-house research activities, procurement, and management of contract research. The Federal staff of 300 employees is about 2/3 professional (engineers, chemists, etc.). A new Director was appointed at METC in April 1990 after 15 years of strong top-down leadership. Among the challenges facing the new Director was a desire to modify the "culture" of the Center to a more participative style coupled with a growing pressure on the efficient use of resource and sustainable worker productivity in the Federal sector. The introduction of a total quality management (TQM) system was viewed as the most appealing proven technique to stimulate the needed changes. A number of activities were undertaken in the fall of 1990 to initiate this program. The Deming Videotapes were used as a training tool to introduce the concepts to the senior managers. Consultants were engaged to train key workers to "facilitate" group work redesign activities, and several pilot projects were completed to illustrate the techniques in "real" work situations. A steering committee that crosscuts the organizations and levels of employees from workers to senior managers was established and has functioned with some success. A new suggestion system has elicited a significant employee input. A recognition system was put in place, and a newsletter has been established to convey the TQM message.

20504 (DOE/MI/10158–1) **Implementation of a prototype training and networking program for minority entrepreneurs and business people in energy-related fields: Final report, July 1990–June 1991.** Grant, C.D. Bronx Community Coll., New York, NY (United States). Business and Professional Development Inst. [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90MI10158. Order Number DE92011936. Source: OSTI; NTIS; GPO Dep.

In line with these responsibilities of the US Department of Energy, Office of Minority Economic Impact, this project was designed to address problems and implement strategies to assist the underprivileged, minority and entrepreneurs in large metropolitan areas. This project addressed the need for women and minorities to gain access to the many opportunities available in the varied energy-related fields. One way for these "budding entrepreneurs" to become associated with energy-related businesses, learn the ropes, and eventually own a similar business is to be exposed to the guidance of an established business. Toward that end, a series of relevant projects have been identified with the assistance of the Small Business Administration (SBA), the private sector, and the Department of Energy (DOE).

20505 (DOE/RL–91/09) **Hanford 300 Area Development Plan.** Daly, K.S. (Westinghouse Hanford Co., Richland, WA (United States)); Seiler, S.W.; Hail, J.C. USDOE Richland Operations Office, WA (United States). Sep 1991. 162p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012593. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Hanford 300 Area Development Plan (Development Plan) is to guide the physical development of the 300 Area in accordance with US Department of Energy (DOE) Order 4320.1B (DOE 1991b) by performing the following: (1) Establishing a land use plan, setting land use categories that meet the needs of existing and proposed activities; (2) Coordinating existing, 5-yr, and long-range development plans and guiding growth in accordance with those plans; (3) Establishing development guidelines to encourage cost-effective development and minimize conflicts between adjacent activities; (4) Identifying site development issues that need further analysis; Integrating program plans with development plans to ensure a logical progression of development; and, (6) Integrating DOE plans with local agency plans (i.e., city, country, state, and Tri-Cities Science and Technology Park plans).

20506 (DOE/RL–91-49) **United States Department of Energy Richland Field Office Environmental Protection Implementation Plan, November 9, 1991–November 9, 1992.** Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012163. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Order 5400.1 (DOE 1988a), General Environmental Protection Program, establishes environmental protection program requirements, authorities, and responsibilities to ensure that DOE operations are in compliance with applicable Federal, State and local environmental protection laws and regulations, executive orders, and internal department policies. Chapter 3 of DOE Order 5400.1 requires that each DOE Field Office prepare a plan for implementing the requirements of this order and update the plan annually. Therefore, this update to the US Department of Energy – Richland Operations Office Environmental Protection Implementation Plan (DOE-RL 1989a), initially prepared November 9, 1989, is being issued.

20507 (DOE/SSDC–76-45/4-Rev.3) **Mort User's Manual: For use with the Management Oversight and Risk Tree analytical logic diagram: Revision 3.** Knox, N.W.; Eicher, R.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). System Safety Development Center. Feb 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (SSDC–4-Rev.3). Order Number DE92013785. Source: OSTI; NTIS; GPO Dep.

This report contains the User's Manual for MORT (Management Oversight and Risk Tree), a logic diagram in the form of a "work sheet" that illustrates a long series of interrelated questions. MORT is a comprehensive analytical procedure that provides a disciplined method for determining the causes and contributing factors of major accidents. Alternatively, it serves as a tool to evaluate the quality of an existing system. While similar in many respects to fault tree analysis, MORT is more generalized and presents over 1500 specific elements of an ideal "universal" management program for optimizing environment, safety and health, and other programs. This User's Manual is intended to be used with the MORT diagram dated February 1992.

20508 (EGD-CERCLA–001/-0590) **Federal Environmental Reporting Requirements Handbook.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Environmental Guidance Div. May 1990. 90p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The Environmental Reporting Requirements Handbook has been developed by DOE Headquarters' Environmental Guidance Division (EH-231) in order to assist DOE Field Organizations in the identification of the various reporting the notification requirements mandated by Federal environmental laws, regulations, and Executive Orders. The Handbook makes a distinction between "routine" and "non-routine" reporting/notification requirements. Routine reporting requirements include the submission of documents that are required either on a regular basis, such as annual or biennial reports, or periodic notifications that result from what would be considered "normal" operations, such as Material Safety Data Sheet (MSDS) updates that are required when new information not contained on previous MSDS submissions is discovered. Non-routine reporting requirements are generally associated with occurrences that represent significant deviations from regulated or planned performance; examples include the unintentional discharge of oil or hazardous substances.

20509 (ER-B-92-04) **Argonne National Laboratory's use of government supply sources.** USDOE Office of Inspector General, Oak Ridge, TN (United States). Eastern Regional Audit Office. 17 Mar 1992. 12p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The purpose of the audit was to evaluate Argonne's use of Government supply sources. The objective of the audit was to determine whether Argonne had used Government supply sources when these sources were available, economically advantageous, or otherwise in the Government's best interest.

20510 (ER-B-92-05) **Travel at Princeton Plasma Physics Laboratory.** USDOE Office of Inspector General, Oak Ridge, TN (United States). Eastern Regional Audit Office. 17 Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

Our audit disclosed that Princeton Plasma Physics Laboratory (PPPL) did not always comply with the travel requirements of its contract. Specifically: (1) Travelers were routinely reimbursed for lodging costs without receipts; (2) other travel costs were not always adequately documented; (3) supervisors did not always review and approve travel before or after trips; and (4) travel advances exceeded contract limitations. These conditions resulted because laboratory management decided that lodging receipts were not required by the contract, so they did not enforce contract travel requirements. Consequently, $301,073 of travel costs were not in compliance with the contract and are therefore unallowable. Accordingly, we recommend that the Acting Manager, Department of Energy Chicago Field Office, direct the laboratory to comply with the contract's travel requirements and recover these unallowable travel costs. Management concurred with our recommendations to direct PPPL to comply with the travel requirements of its contract but did not occur that PPPL incurred costs that were not in compliance with its contract and should be disallowed and refunded. Management did not concur with the conclusion that PPPL's management of travel expenses represents a material internal control weakness.

20511 (ER-B-92-06) **Selected aspects of the Governor's Office of Energy Programs management of Petroleum Violation Escrow funds State of South Carolina.** USDOE Office of Inspector General, Oak Ridge, TN (United States). Eastern Regional Audit Office. 20 Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The purpose of the audit was to determine the propriety of certain matters concerning the Governor's Office of Energy Programs management of the Warner Amendment and Exxon Petroleum Violation Escrow (PVE) funds. The audit objective was to answer the following issues concerning use of Warner Amendment and Exxon funds.

20512 (INIS-GB-439) **The Department of Energy's nuclear R and D programmes [United Kingdom]: Consultation document.** Department of Energy, London (United Kingdom). Aug 1991 122p. Order Number DE92628415. Source: OSTI; NTIS (US Sales Only); INIS.

This Consultation Document reviews how the United Kingdom Department of Energy's nuclear R and D programmes support the Government's nuclear policy and reaches preliminary conclusions about their future direction. It describes the changes the Department has adopted, and is proposing, to ensure that it is better informed about the nuclear R and D it commissions and that the work is carried out cost-effectively. The areas of research reviewed are: safety; radiological protection; safeguards; reactor technology; fusion; decommissioning and waste management. (author).

20513 (INIS-mf-13180) **Annual report 1989.** Bhabha Atomic Research Centre, Bombay (India). Dec 1990 147p. Order Number DE92627154. Source: OSTI; NTIS (US Sales Only); INIS.

The main thrust of various research and development activities of the Bhabha Atomic Research Centre (BARC) is directed towards: (1) supporting nuclear power programme in all its aspects which include design of nuclear reactors, development of nuclear fuel and materials, and management of nuclear waste, (ii) producing radioisotopes and promoting their applications in agriculture, medicine and industries, and (iii) providing research and development and service backup to ensure health and radiation protection in nuclear facilities. BARC also carries out R and D work in frontier areas of science like plasma and fusion physics, accelerators and lasers, high temperature superconductivity, condensed mater physics, high pressure physics, high resolution spectroscopy, chemical reaction dynamics, laser induced chemistry, electronics, robotics, radiation biology, and genetic engineering. These R and D activities during 1989 are described in brief in the chapters entitled: Physical Sciences, Chemical Sciences, Materials and Materials Sciences, Radioisotopes, Reactors, Fuel Cycle, Radiological Safety and Protection, Electronics and Instrumentation, Engineering Services, and Life Sciences. The last chapter entitled General describes the supporting activities like technical information services, industrial safety etc. At the end of each chapter, a list of publications during the year by scientists of the Centre in the corresponding field is given. (M.G.B.).

20514 (INIS-mf-13181) **Annual report 1990-91.** Department of Atomic Energy, Bombay (India). 1991 118p. Order Number DE92627155. Source: OSTI; NTIS (US Sales Only); INIS.

The annual report of the Department of Atomic Energy (DAE), India, for the fiscal year 1990-91 describes: (1) the research and development work carried out by DAE's various research establishments and by fully funded research institutes, (2) performance of nuclear power stations, nuclear fuel complex, fuel reprocessing plants and heavy water plants, (3) exploration work for atomic minerals, (5) regulatory and safety functions, (6) performance of public sector undertakings, namely Indian Rare Earths Ltd., Electronics Corporation of India Ltd., and (6) other activities like international relations, emergency planning, financial assistance to research projects, etc. During the year, 6182 MUs electricity was generated, Unit-1 of Narora Atomic Power Station commenced commercial operation, Hazira Heavy Water Plant was commissioned, Sewage Hygienisation Research Irradiator at Baroda and Heavy Rare Earths Oxide Plant at Udyogmandal were also commissioned, promising geologic deposits of uranium were found at Domiasat (Meghalaya), and PURNIMA-III attained criticality. (M.G.B.).

20515 (KCP-613-4849) **Team based Daily Problem Solving: When groups problem solve, everyone listens.** Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-920494-3: Association for Quality and Participation (AQP) annual spring conference, Seattle, WA (United States), 6-9 Apr 1992). Order Number DE92011342. Source: OSTI; NTIS; GPO Dep.

Team based Daily Problem Solving (DPS) is designed to identify root-cause and solutions to problems at the core level in a fast and expedient manner using the subject experts. DPS emphasizes team work over individual effort. This system can be used in any work environment.

20516 (KCP-613-4854) **Gateway to total participation: The reality of staying competitive in the 1990s.** Cooper, B.; Reynolds, D.; Shepherd, D. Allied-Signal Aerospace Co., Kansas

City, MO (United States). Kansas City Div. Mar 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-920494–4: Association for Quality and Participation (AQP) annual spring conference, Seattle, WA (United States), 6-9 Apr 1992). Order Number DE92011341. Source: OSTI; NTIS; GPO Dep.

People Involvement activities are used to bridge all aspects of our manufacturing business. This involvement is evident in the daily operation meetings conducted for information sharing, problem solving, concurrent engineering, and planning the work day as a business unit. Our business structure promotes total participation and fosters individual development.

20517 (LA–12198-MS) **The leadership of philosopher kings.** Canavan, G.H. Los Alamos National Lab., NM (United States). May 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92012564. Source: OSTI; NTIS; GPO Dep.

A "rule of seven" implies a scientific organization in which each leader is expected to contribute technically, giving each member a responsibility for the creative work needed for effective leadership. It would decentralize leadership, pushing decisions down to the level where they should be made. Such a structure need not be imposed from above.

20518 (LUTFD2-TFRT–4019-1-71-1991) **Activity Report 1990-1991.** Dagnegaard, E.; Aastroem, K.J. (eds.). Lund Univ. (Sweden). Dept. of Automatic Control. Oct 1991. 71p. Order Number DE92628416. Source: OSTI; NTIS (US Sales Only); INIS.

This report covers the activities at the Department of Automatic Control at Lund University during the period 1 July 1990 - 30 June 1991, which is the academic year 1990/91. During this period Bo Eliasson and Lars Rundqwist completed their PhD theses. This brings the total number of PhDs graduating from our department to 33. Twenty-one students completed their MSc degree at the department. One book, seventeen journal papers and 48 conference papers were published by staff members. Research has continued in established areas such as adaptive control, expert control, computer aided control engineering, robotics, and information technology.

20519 (NUREG–1414) **Differing professional views or opinions: 1990 Special Review Panel.** Bird, P.E.; Heltemes, C.J. Jr.; Hearn, P.C.; Montgomery, J.M. Nuclear Regulatory Commission, Washington, DC (United States). Apr 1992. 62p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO.

In December 1989, the Executive Director Operations of the US Regulatory Commission (NRC) appointed a Special Review Panel to evaluate the effectiveness of NRC Manual Chapter 4125, Differing Professional Views or Opinions, and NRC Manual Chapter 4126, Open Door Policy. In accordance with Section E of NRC Appendix 4125, the Panel was responsible for assessing "... the informal and formal processes for dealing with differing professional views or opinions, including the effectiveness of the processes, how well they are understood by employees, and the organizational climate for having these views and opinions aired and properly decided." This report presents the Special Review Panel's evaluation of the NRC's current process for dealing with Differing Professional Views or Opinions. Provided in this report are the results of an employee opinion survey on the process; highlights and suggestions from interviews with individuals who had submitted a Differing Professional view or Opinion, as well as with agency managers directly involved with the Differing Professional Views or Opinions process; and proposed revisions to Manual Chapters 4125 and 4126.

20520 (OUP–91-31) **List of publications 1990: Scientific and specialist works from Department of Physics.** Oslo Univ. (Norway). Fysisk Inst. Dec 1991. 50p. (In Norwegian). Order Number DE92628417. Source: OSTI; NTIS (US Sales Only); INIS.

This annual bibliography of publications refers to research reports, contribution to newspapers and scientific journals, guest lectures, and popular science lectures.

20521 (PNL-SA–20246) **Compression planning for continuous improvement in quality programs.** Willis, Y.A. (Willis Consulting, PA (United States)); Hood, F.C. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920430–83: International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92012331. Source: OSTI; NTIS; GPO Dep.

This paper describes an innovative approach to planning and prioritizing. The approach, "Compression Planning," conserves time for the planners while building commitment to continuous improvement and implementation of the plan. Beginning May 1990, "Compression Planning" was applied to the first organization-wide effort at training integration for regulatory compliance at Battelle Pacific Northwest laboratory (PNL), a multi-program national laboratory. Various applications of this methodology have been used at PNL for programs since then.

20522 (RISO-M–2944) **Nuclear Safety Research Department. Annual progress report 1990.** Heikel Vinther, F. (ed.). Risoe National Lab., Roskilde (Denmark). Nuclear Safety Research Dept. Jul 1991. 36p. Order Number DE92628418. Source: OSTI; NTIS (US Sales Only); INIS.

The report describes the work of the Nuclear Safety Research Department during 1990. The activities cover health physics, reactor physics, operation of the educational reactor DR 1, and waste management. Lists of staff and publications are included together with a summary of participation in international working groups etc. (au) 3 ills., 30 refs.

20523 (SAND–92-0323) **Purchasing and Materials Management Organization, Sandia National Laboratories: Annual report, fiscal year 1991.** Zaeh, R.A. Sandia National Labs., Albuquerque, NM (United States). Apr 1992. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013676. Source: OSTI; NTIS; GPO Dep.

This report contains the purchasing and materials management operating highlights for Fiscal Year 1991. Included in the report are compiled data on: personnel; type of procurement; small business procurements; disadvantaged business procurements; woman-owned business procurements; New Mexico commercial business procurements; Bay Area commercial business procurements; commitments by states and foreign countries to commercial suppliers; and, transportation activities. Other statistical data tables enumerate the following: the twenty-five commercial contractors receiving the largest dollar commitments; commercial contractors receiving commitments of $1000 or over; integrated contractor and federal agency commitments of $1000 or over from Sandia National Laboratories-Albuquerque and Livermore; and, transportation commitments of $1000 or over from Sandia National Laboratories-Albuquerque and Livermore.

20524 (SAND–92-0407C) **Strategies for change within Sandia National Laboratories.** Burcham, W.R. Sandia National Labs., Albuquerque, NM (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9204116–1: 8. annual Performance Management Association conference, San Francisco, CA (United States), 1-3 Apr 1992). Order Number DE92012375. Source: OSTI; NTIS; GPO Dep.

This paper identifies some of the sources of resistance to change that face Sandia National Laboratories' management, and examines the mechanisms that are being used to minimize the effects of that resistance. The rapid and radical nature of many of the changes now being demanded of Sandia make them all the more likely to meet stiff resistance from within the organization. Sandia's management has attempted to anticipate some of the sources of resistance to the changes planned for its operating procedures and has taken action to minimize their effects. Within this paper, particular attention is given to those individuals who will not only be most effected by, by may also be required to implement the changes. The change process at Sandia is currently ongoing. It is not complete. No claim is made that all of the changes that will be necessary at Sandia National Laboratories have been recognized, nor that all sources of resistance have been anticipated.

20525 (SAND–92-0477C) **Files improvement the NARA way.** Pasterczyk, C. Sandia National Labs., Albuquerque, NM (United States). 19 Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9203113–1: 1992 spring seminar Rio Grande chapter Association of Records Managers and Administrators, Albuquerque, NM (United States), 19 Mar 1992). Order Number DE92011139. Source: OSTI; NTIS; GPO Dep.

The purpose of this talk is to set the scene with a definition of records management, records and federal records. It is also to introduce some techniques to ensure that office files are properly organized and maintained, rapidly retrievable, complete, and ready for appropriate disposition the NARA (National Archives and Records Administration) way.

20526 (SAND–92-0487) **An annotated bibliography of selected books and articles on benchmarking.** Allan, F.C. (comp.). Sandia National Labs., Albuquerque, NM (United States). Jan 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92013650. Source: OSTI; NTIS; GPO Dep.

This bibliography contains 34 references concerning utilizing benchmarking in the management of businesses. Books and articles are both cited. Methods for gathering and utilizing information are emphasized. (GHH)

20527 (SAND–92-0810C) **The technology-based regional economic development program at Sandia National Laboratories.** Allen, M.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9206151–1: Technology Transfer Society (TTS) conference, Athens, GA (United States), 24-26 Jun 1992). Order Number DE92011664. Source: OSTI; NTIS; GPO Dep.

In November of 1989, technology transfer became a mission for Sandia National Laboratories, (SNL), with the passage of the National Competitiveness Technology Transfer Act. In order to address the specialized technology transfer needs of small businesses, SNL created and implemented the Technology-Based Regional Economic Development (TRED) program. The TRED model has two major components – technology assistance (or teaming), and " widget transfer." In the technology assistance component, SNL's technology resources (expertise, services, and equipment) are made available to companies developing commercial products. In the "widget transfer" component, SNL's intellectual property (patents, copyrights) is placed with private sector firms through various partnership intermediaries.

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Refer also to citation(s) 17707, 17732, 17733, 17771, 17806, 17808, 17814, 17817, 17822, 17839, 17916, 17937, 17973, 17974, 17976, 17978, 18004, 18032, 18039, 18064, 18071, 18085, 18217, 18292, 18294, 18303, 18313, 18314, 18323, 18324, 18341, 18373, 18374, 18375, 18377, 18381, 18382, 18395, 18417, 18420, 18421, 18429, 18546, 18548, 18549, 18550, 18551, 18552, 18553, 18554, 18555, 18556, 18557, 18558, 18563, 18564, 18567, 18569, 18579, 18580, 18581, 18590, 18593, 18597, 18656, 18725, 18759, 18763, 18820, 18825, 18830, 18884, 18899, 18905, 18906, 18910, 18914, 19040, 19068, 19071, 19072, 19074, 19075, 19078, 19081, 19087, 19096, 19098, 19100, 19105, 19106, 19118, 19120, 19131, 19137, 19152, 19161, 19162, 19165, 19177, 19200, 19201, 19321, 19345, 19353, 19357, 19360, 19361, 19367, 19370, 19371, 19379, 19391, 19392, 19394, 19399, 19437, 19444, 19452, 19537, 19553, 19565, 19770, 19905, 19908, 19917, 19923, 19933, 19951, 19970, 19976, 19977, 19979, 20020, 20250, 20259, 20260, 20262, 20264, 20283, 20290, 20291, 20292, 20295, 20352, 20353, 20354, 20355, 20356, 20357, 20367, 20372, 20400, 20421, 20428, 20434, 20445, 20507, 20627, 20628

20528 (AECL–10507) **Ewe: a computer model for ultrasonic inspection.** Douglas, S.R.; Chaplin, K.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.; Ontario Hydro, Toronto, ON (Canada). Nov 1991. 55p. (COG–91-261.). Order Number DE92627145. Source: OSTI; NTIS (US Sales Only); INIS.

The computer program EWE simulates the propagation of elastic waves in solids and liquids. It has been applied to ultrasonic testing to study the echoes generated by cracks and other types of defects. A discussion of the elastic wave equations is given, including the first-order formulation, shear and compression waves, surface waves and boundaries, numerical method of solution, models for cracks and slot defects, input wave generation, returning echo construction, and general computer issues.

20529 (ANL–91/34, pp. 1) **Interfacing performance measurement capabilities into a parallel language compiler.** Kesselman, C. (California Inst. of Tech., Pasadena (United States)). Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

When developing a parallel program, one is ultimately interested in how effectively that program uses the parallel computer on which it runs. In this sense, identifying and eliminating performance bottlenecks is central to parallel computing. The number of times a procedure executes on a processor, or how much time is spent waiting for interprocessor communication are typical of the types of information needed to identify and eliminate performance bottlenecks. A means for measuring quantities such as these is essential to any practical parallel programming system. Recognizing this, facilities for performance measurement have been integrated into the programming environment for Program Composition Notation (PCN), a parallel programming language based on program composition, single assignment variables, and recursively defined data structures. Facilities for performance measurement were designed into the PCN implementation from the beginning. The approach the author has taken combines novel measurement techniques with statistical performance models to provide performance measurements with extremely low overhead. In this talk, he will discuss issues in the design of performance measurement systems for parallel programs and he will show how these issues have been addressed in PCN. An overview of the implementation of performance measurement in PCN will be given, paying particular attention to the influence measurement had on the design of the PCN implementation and the PCN compiler.

20530 (ANL–91/34, pp. 2-17) **Message-oriented parallel implementation of moded flat GHC.** Ueda, Kazunori (Inst. for New Generation Computer Technology, Tokyo (Japan)); Morita, Masao. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The authors proposed in [UM90] a new, message-oriented implementation technique for Moded Flat GHC that compiles unification for data transfer into message passing. The technique was based on constraint-based program analysis that was amenable to separate compilation, and significantly improved the performance of programs that used goals and streams to implement reconfigurable data structures. In this paper they discuss how the technique can be parallelized. They focus on the shared-goal method for shared-memory multiprocessors, though a different scheme could be used for distributed-memory multiprocessors. Unlike other parallel implementations of concurrent logic languages which they call process-oriented, the unit of parallel execution is not an individual goal but a chain of message sends caused successively by an initial message send. Parallelism comes from the existence of different chains of message sends that can be executed independently or in a pipelined manner. Mutual exclusion based on busy waiting and on message buffering controls access to individual, shared goals. Typical goals allow last-send optimization, the message-oriented counterpart of last-call optimization. They are building an experimental implementation on Sequent Symmetry. In spite of the simple scheduling currently adopted, preliminary evaluation shows good parallel speedup and good absolute performance for concurrent operations on binary process trees.

20531 (ANL–91/34, pp. 18-29) **An overview of the Fortran D programming system.** Hiranandani, Seema, (Rice Univ., Houston, TX (United States)); Kennedy, K.; Koelbel, C.; Kremer, U.; Chauwen Tseng. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The success of large-scale parallel architectures is limited by the difficulty of developing machine-independent parallel programs. The authors have developed Fortran D, a version of Fortran extended with data decomposition specifications, to provide a portable data-parallel programming model. This paper presents the design of two key components of the Fortran D programming system: a prototype compiler and an environment to assist automatic data decomposition. The Fortran D compiler addresses program partitioning, communication generation and optimization, data decomposition analysis, run-time support for unstructured computations, and storage management. The Fortran D programming environment provides a static performance estimator and an automatic data partitioner. They believe that the Fortran D programming system will significantly ease the task of writing machine-independent data-parallel programs.

20532 (ANL–91/34, pp. 30-37) **OSCAR FORTRAN compiler.** Kasahara, H. (Waseda Univ., Tokyo (Japan)); Honda, H.; Aida, K.; Okamoto, M.; Narita, S. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

Oscar Fortran compiler has been developed for a shared memory multiprocessor system named OSCAR (Optimally Scheduled Advanced Multiprocessor). The compiler hierarchically exploits coarse grain parallelism among loops, subroutines and basic blocks, medium grain parallelism among loop-iterations and near fine grain parallelism among statements. The coarse grain parallelism is automatically detected in the form of earliest executable conditions of the coarse grain tasks, or the macro-tasks. The earliest executable conditions are obtained by a united control dependence and data dependence analysis. The macrotasks are dynamically assigned to processor clusters by a scheduling routine generated by the compiler. A macrotask composed of a Do-all or Do-across loop, which is assigned onto a processor cluster, is hierarchically processed in parallel in the medium grain by processors inside the processor cluster. A macrotask composed of a sequential loop or a basic block on a processor cluster is also processed in parallel in the near fine grain by using static scheduling. A prototype compiler has been implemented on OSCAR having sixteen RISC processors and its usefulness has been confirmed on the system.

20533 (ANL–91/34, pp. 38-39) **Coordination language design and implementation issues.** Lucco, S. (California Univ., Berkeley (United States)); Sharp, O. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

One can think of a parallel program as a group of sequential sub-computations which cooperate to solve a problem. To exploit existing code and optimization tools, programmers usually choose to write these sub-computations in traditional imperative languages such as C, Fortran, or Lisp. A coordination language expresses data exchange and synchronization among such sub-computations. The authors are investigating the effectiveness of coordination languages as tools for concise expression and efficient implementation of parallel programs. In this presentation, they will outline some design and implementation issues critical to the expressiveness and performance of coordination languages. Using these criteria, they will compare existing coordination languages including Strand, PCN, Linda, Jade, Delirium, and extended Fortran dialects.

20534 (ANL–91/34, pp. 40-57) **Designing imperative programming languages for analyzability: Parallelism and pointer data structures.** Hendren, L. (McGill Univ., Longueuil, Quebec (Canada)); Gao, G.R. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The rapid advance of computer architectures has provided important new challenges for programming language designers and compiler writers alike. One of these challenges is to provide programming languages that are analyzable so that compilers can effectively exploit the level of parallelism that is necessary for effective use of such architectures. Historically, the analysis of scientific programs using arrays has made crucial use of information such as array dimension and size, the mathematical structure of arrays, and the regularity of the looping constructs used for programming with arrays. In this paper the authors argue that, just as arrays are important in scientific programs, pointer data structures often play a central role in non-scientific and symbolic programs, and therefore the analyzability of pointer data structures is critical. To illustrate both the importance of analyzability for programs with pointer data structures and the solution methodology proposed in this paper, they propose a programming language mechanism which significantly enhances the analyzability of pointer-based data structures frequently used in non-scientific programs. In this paper they give an overview of their approach to designing analyzable imperative languages. They give a concrete example of applying the techniques to exploit fine-grain parallelism in while loops that traverse linked list structures. The effectiveness of their approach is demonstrated by applying it to a collection of loops found in typical non-scientific C programs. In addition, they outline how their approach can be used to exploit coarse-grain parallelism, and they give some challenges open in this area.

20535 (ANL–91/34, pp. 58-59) **Compile-time parallelization of Prolog.** Millroth, H. (Uppsala Univ., Nykoeping (Sweden)). Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

Previous attempts at developing parallel Prolog systems have focused on exploiting AND-parallelism, or OR-parallelism, or both. In this work the author parallelizes Prolog by exploiting parallelism in its fundamental control structure: recursion. They have developed a compilation technique in which recursion over recursive data structures is compiled to bounded iteration (for-loops) over vectors (the vectors are somewhat analogous to binding environments). The technique is based on an analysis of the unification patterns of recursive programs in Reform computations. (Reform is a new inference systems for logic programming which handles recursion differently from SLD-resolution.) This compilation technique gives a more efficient parallelization of recursive programs than is possible with a system based on SLD-resolution. In a parallel system based on SLD-resolution it takes O(N) time to spawn all N recursive calls to the program. In this model, the time complexity for getting all recursion levels into work is bounded only by the time it takes to distribute the input data of the program. This may take O(log N) time (on, for example, a machine with tree topology) or O(1) time (in case the input data is already distributed).

20536 (ANL–91/34, pp. 60-72) **Compiling Crystal for massively parallel machines.** Chen, M. (Yale Univ., New Haven, CT (United States)); Youngil Choo. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The Crystal project has focused on making the task of programming massively parallel machines practical while not sacrificing the efficiency of the target code. The compilation strategy is to start from a high-level problem specification, apply a sequence of optimizations tuned for particular parallel machines, and finally generate code with explicit communication or synchronization. The computation and data are distributed based on the analysis of communication patterns in the program and the cost of communication primitives of the target machine. Taking advantage of the fact that many algorithms exhibit natural parallelism when formulated mathematically, the approach to parallel programming is to use a purely functional language that resembles mathematical notation. The language has higher-order operators and data structures, thereby making the extraction of parallelism far simpler and allowing us to focus on the global communication issues for massively parallel machines. The simpler semantics of the language allows one to formulate a rigorous theory of program optimization that is indispensable both in the automatic analysis of communication patterns and the explicit specification of user-defined mapping strategies.

20537 (ANL–91/34, pp. 73-85) **A new method for compile-time granularity analysis.** Zhong, X. (Univ. of Oregon, Eugene (United States)); Tick, E.; Duvvuru, S.; Hansen, L.; Sastry, A.V.S.; Sundararajan, R. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The authors present a new granularity analysis scheme for concurrent logic programs. The main idea is that, instead of trying to estimate costs of goals precisely, they provide a compile-time analysis method which can efficiently and precisely estimate relative costs of active goals given the cost of a goal at runtime. This is achieved by estimating the cost relationship between an active goal and its subgoals at compile time, based on the call graph of the program. Iteration parameters are introduced to handle recursive procedures. Compared with methods in the literature, this scheme has several advantages: it is applicable to any program, it gives a more precise cost estimation than static methods, and it has lighter runtime overheads than absolute estimation methods.

20538 (ANL–91/34, pp. 86-92) **GST: Grain-size transformations for efficient execution of symbolic programs.** Chien, A.A. (Univ. of Illinois, Urbana (United States)); Wuchen Feng. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

Controlling grain size is a key issue which spans programming approaches and machine architectures in parallel systems. The ability to effectively adjust program grain size, is a critical component of achieving efficient, portable parallel programming. A number of programming models have been used to express application programs with large quantities of fine-grained concurrency. Unfortunately, despite rapid improvements in processor architecture, the authors currently cannot exploit such fine-grained concurrency efficiently. Even if such architectures were available, portability issues motivate the development of grain-size control techniques. They are pursuing the construction of a grain-size transformer system which merges grains, increasing the execution grain size for more efficient execution.

20539 (ANL–91/34, pp. 93-107) **Using domain-specific, abstract parallelism.** Baxter, I. (Schlumberger Lab. for Computer Science, Austin, TX (United States)); Kant, E. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

Discovery of potential parallelism in low level code is difficult, especially in the absence of problem domain knowledge. An alternative is to explicitly represent maximal potential parallelism in abstract program components. A transformation system refines a program composed of such components into a concrete program. The authors discuss an experimental system in which they are installing such facilities. An example refinement sequence is provided.

20540 (ANL–91/34, pp. 108-110) **Applying abstract interpretation to identify vectorizable numerical code in logic programs.** Bansal, A.K. (Kent State Univ., OH (United States)); Poduval, D.S. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

In this paper, the authors describe an application of abstract interpretation to identify the vectorizable numerical code. This vector analysis scheme derives definite iteration, the information about bound and indices, identification of vectors simulated by lists or functors, and the derivation of vector-size. The vector analysis scheme is based upon extending abstract domain from type domain to the abstract domain as vector domain. Vector domain is a superset of type domain and includes vector related information along with typed related information. However, they differentiate between the two different modules, namely abstract interpretation in type domain and abstract interpretation in vector domain since the output of type domain is also used for producer-consumer analysis, identifying different types of parallelism, and identifying deterministic code - codes which have no alternative solution. The vector analysis scheme has five components, namely, generalization, vector unification, vector summarization, concretization, and iteration analysis. The first four components are used to propagate and collect the information in the vector domain and the last component uses solving a system of linear equation to derive the vector-size information, and the identification and disambiguation of index and bounds for iterative constructs simulated using tail recursive programs. They describe various schemes and explain the algorithms. They also discuss the current issues to integrate AND, OR, and stream parallelism with vectorization.

20541 (ANL–91/34, pp. 111-113) **Data locality.** Lam, M.S. (Stanford Univ., CA (United States)). Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

Previous research on parallelizing compilers for sequential imperative programming languages concentrated on the extraction of parallelism. Recent results in the area indicate that the extraction of parallelism is only the first step. The discovery of a large amount of parallelism does not necessarily translate to a gain in performance because the overhead in synchronization and communication can render parallelization ineffective. Improving data locality, thus reducing the communication overhead, will become even more important as processor speeds continue to increase much faster than communication and memory access rates. The study of parallelism must therefore be coupled with the study of locality. While standard scalar optimizations aim to reduce the total instruction count in a program, locality optimizations rearrange the computation to reduce the cost of data accesses by taking better advantage of the memory hierarchy. The author takes a three-tiered approach to the problem: first, she tries to group operations that use the same block of data as a unit of computation allocated to a processor. In this way, the cost of fetching the data is amortized across all the operations using the data. If this technique does not reduce the communication adequately, she tries to allocate the computation and data to processors in a way that minimizes interprocessor communication. Lastly, if communication is unavoidable, she tries to hide the latency of the communication by overlapping the data fetches with computation on other data. She has been focusing on two different computation domains which require different techniques in gathering the information necessary for locality optimizations. They are dense matrix computations where a fully automatic compiler approach is feasible, and coarse-grain tasks where linguistic support is necessary.

20542 (ANL–91/34, pp. 114-128) **Compiling FP for data-parallel systems.** Walinsky, C. (Dartmouth Coll., Hanover, NH (United States)); Banerjee, D. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

In data-parallel programming, operations are performed simultaneously on all elements of large data structures. Backus's FP functional language promotes this view. FP provides a large set of data rearrangement primitives, and a useful set of functional combining forms that are applied to entire data structures. The authors present an overview of an FP compiler that generates programs capable of exploiting data-parallelism. The FP compiler determines the effects of data rearrangement functions at compile-time, thereby avoiding creation of large intermediate data structures, and reducing communication overhead. FP and its compiler are formally specified, reducing ambiguity concerning constructs of the language and results of the compiler.

20543 (ANL–91/34, pp. 129-148) **Improving compilation of implicit parallel programs by using runtime information.** Sargeant, J. (Univ. of Manchester (United Kingdom)). Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

In the quest for the Holy Grail of efficient implicit parallelism, the authors have opted for a conventional architecture with physically distributed but virtually shared memory (The EDS machine), and a Large Grain Graph Rewriting computational model. On programming languages, they hedge their bets, but the work described here uses a (strict) functional language. This set of choices eliminates many of the problems and brings those which remain into sharp focus. All they need to do is achieve efficient dynamic load balancing, high granularity, and good data structure locality. They are investigating an approach whereby the program is first compiled with monitoring code inserted, and run (using relatively small data sets) to produce statistics which are fed back into the compiler which then produces optimized parallel code. For strict functional programs, the production of statistics is straightforward, although automatically using them effectively is not. The paper discusses a number of issues, including the effect of higher-order functions and other more advanced language features, and various practical problems. This work is embryonic, but the method seems to have significant advantages over static analysis or hand annotation, and also provides extra performance information for the programmer.

20544 (ANL–91/34, pp. 149-160) **Generalized iteration space and the parallelization of symbolic programs.** Harrison, L. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

A large body of literature has developed concerning the automatic parallelization of numerical programs, and a quite separate literature has developed concerning the parallelization of symbolic programs. Because many symbolic programs make heavy use of array data and iterative constructs, in addition to more symbolic language features like pointers and recursion, it is desirable to fuse these bodies of work so that results developed for numerical programs can be applied to symbolic ones, and generalized so that they apply to the variety of language constructs encountered in symbolic computations. In this paper is described a framework, called generalized iteration space, that allows one to unify dependence analysis of array computations with dependence analysis of pointer computations. It is shown that subscripted array accesses as well as pointer dereferences can be seen as linear functions of generalized iteration space. The author is applying this framework to the automatic parallelization of C and Lisp programs in two parallelizing compilers at CSRD, called Parcel [Har89] and Miprac [HA89].

20545 (ANL–91/34, pp. 161) **Dataflow analysis of concurrent logic languages.** Foster, I. (Argonne National Lab., IL (United States)); Winsborough, W. Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The authors present a framework for the definition and verification of static analyses of concurrent logic programming languages. They illustrate the framework by constructing an analysis to recognize consumers that receive data structures that have no other consumer. Such information enables a compile-time decision to reuse data-structure storage when the consumer is done with it. The principal feature of the analyses constructed using their approach is that they need not simulate directly the numerous possible interleavings of process reductions that can occur during execution of a parallel program. This feature is intended to make their analyses affordable.

20546 (ANL–91/34, pp. 162) **Compiler support for the refinement and composition of process structures.** Foster, I. (Argonne National Lab., IL (United States)). Argonne National Lab., IL (United States). Nov 1991. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The author presents recent work concerned with the specification of spatial organization in parallel programs. First, he describes linguistic constructs (defined as extensions to the parallel programming language PCN) that allow specifications for the logic and physical layout of a parallel program to be developed simultaneously, in the same stepwise refinement process. These constructs (described in the attached paper) proved a natural framework for the composition of programs defined in terms of specialized topologies, such as an FFT on a linear array. They also allow us to untangle the problems of specifying layout and program logic: the layout hierarchy can be modified independently of program logic to alter resource allocation decisions, changing performance but not correctness. Second, he describes the compiler techniques used to implement these constructs on distributed memory computers. Source-to-source transformations are used to translate programs augmented with the mapping constructs into simpler programs augmented with calls to mapping libraries. These mapping libraries encode expertise about optimal embeddings of complex topologies in particular physical machines. A novel aspect of the compiler is its use of a programmable transformation system called Program Transformation Notation (PTN). This provides a metalanguage for specifying program transformations.

20547 (ANL–91/34, pp. 163-172) **On the refinement and composition of process structures.** Foster, I. (Argonne National Lab., IL (United States)). Argonne National Lab., IL (United States). Nov 1991. DOE Contract W-31109-ENG-38. (CONF-9110321–: Workshop on compilation of (symbolic) languages for parallel computers, San Diego, CA (United States), 31 Oct - 1 nov 1991). In *Proceedings of the workshop on Compilation of (Symbolic) Languages for Parallel Computers.* 176p. Order Number DE92006819. Source: OSTI; NTIS.

The author has defined a framework within which the familiar ideas of refinement, hierarchy, composition, and reuse can be applied to the development of parallel programs. The key idea underlying this framework is the use of spatial layout as an organizational principle: a context in which to specify replication, composition, communication, and other important issues. The approach has a number of important benefits. First, the ability to embed virtual topologies inside other virtual or physical topologies (by remapping, restriction, or expansion) makes it possible to build complex programs by the composition of simpler programs. This is the case even if subprograms are defined in terms of different topologies. Second, design decisions concerning resource allocation and spatial organization can be decoupled from program logic, as such decisions are expressed in the composition that combines subprograms, not the subprograms themselves. Third, virtual topologies allow the underlying physical topolgy to be either hidden or made visible at various levels of abstraction. This makes it possible both to achieve portability and to write programs that exploit aspects of the underlying hardware. Fourth, virtual topologies provide a convenient context for embedding various data-parallel operations in a MIMD context. For example, it is straightforward to define programs that perform reductions, broadcasts, or SIMD/SPMD computations within a topology.

20548 (ANL/CP-74367) **Comparison of two inductive learning methods: A case study in failed fuel identification.** Reifman, J. (Argonne National Lab., IL (United States)); Lee, J.C. Argonne National Lab., IL (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920538-16: 8. power plant dynamics, control and testing symposium, Knoxville, TN (United States), 27-29 May 1992). Order Number DE92011843. Source: OSTI; NTIS; INIS; GPO Dep.

Two inductive learning methods, the ID3 and Rg algorithms, are studied as a means for systematically and automatically constructing the knowledge base of expert systems. Both inductive learning methods are general-purpose and use information entropy as a discriminatory measure in order to group objects of a common class. ID3 constructs a knowledge base by building decision trees that discriminate objects of a data set as a function of their class. Rg constructs a knowledge base by grouping objects of the same class into patterns or clusters. The two inductive methods are applied to the construction of a knowledge base for failed fuel identification in the Experimental Breeder Reactor II. Through analysis of the knowledge bases generated, the ID3 and Rg algorithms are compared for their knowledge representation, data overfitting, feature space partition, feature selection, and search procedure.

20549 (ANL/CP-74903) **Benchmark problems in which equality plays the major role.** Lusk, E.; Wos, L. Argonne National Lab., IL (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant CCR-8810947. (CONF-9206156-1: 11. conference on automated deduction, Saratoga Springs, NY (United States), 15-18 Jun 1992). Order Number DE92013058. Source: OSTI; NTIS; GPO Dep.

We have recently heard rumors that researchers are again studying paramodulation [Wos87] in the context of strategy for its control. In part to facilitate such research, and in part to provide test problems for evaluating other approaches to equality-oriented reasoning, we offer in this article a set of benchmark problems in which equality plays the dominant role. The test problems are taken from group theory, Robbins algebra, combinatory logic, and other areas. For each problem, we include appropriate clauses and comment as to its status with regard to provability by an unaided automated reasoning program.

20550 (ANL/CP-75316) **Simulation meets reality: Chemical hazard models in real world use.** Newsom, D.E. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by Federal Emergency Management Agency, Washington, DC (United States); Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920428-4: Annual international nuclear power plant simulators conference, Orlando, FL (United States), 6-9 Apr 1992). Order Number DE92010905. Source: OSTI; NTIS; GPO Dep.

In 1989 the US Department of Transportation (DOT), Federal Emergency Management Agency (FEMA), and US Environmental Protection Agency (EPA) released a set of models for analysis of chemical hazards on personal computers. The models, known collectively as ARCHIE (Automated Resource for Chemical Hazard Incident Evaluation), have been distributed free of charge to thousands of emergency planners and analysts in state governments, Local Emergency Planning Committees (LEPCs), and industry. Under DOT and FEMA sponsorship Argonne National Laboratory (ANL) conducted workshops in 1990 and 1991 to train federal state local government, and industry personnel, both end users and other trainers, in the use of the models. As a result of these distribution and training efforts ARCHIE has received substantial use by state, local and industrial emergency management personnel.

20551 (ANSTO-M-120) **Automation of the ANSTO working standard of measurement for the activity of radionuclides.** Buckman, S.M. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Aug 1990. 105p. Order Number DE92627146. Source: OSTI; NTIS (US Sales Only); INIS.

The ANSTO working standard ion chamber is used routinely for the standardisation of a range of gamma emitting radio-isotopes. The ion chamber has recently been automated by replacing the AAEC type 292 Recycling Discriminator, timer module and model 43 teletype printer with the HP86B computer, HP-59501B voltage programmer and HP-6181C current source. The program 'MEASION', running on the Deltacom IBM AT clone, calculates the radioactivity, with full error statements, from the ion chamber measurements. Each of these programs is listed and discussed. 13 refs., 5 figs., tabs.

20552 (BONN-IR-92-04) **Development of the parallel calculator system BOSS for the evaluation of the measurement data of the SAPHIR experiment.** Manns, J. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Feb 1992. 77p. (In German). Order Number DE92517031. Source: OSTI; NTIS (US Sales Only); INIS.

The BOSS parallel computing system has been developed for the SAPHIR experiment at the Bonn stretcherring ELSA. The hardware of BOSS consists of some UNIX workstations connected with a standard ETHERNET link. The system will automatically distribute tasks to optimize the use of the computing power of all machines. The elements of parallism are programs which are connected using TCP/IP channels. The system was designed to allow the complete software development to be done under VAX/VMS. Most of this software can be executed using the BOSS system without any modifications. BOSS can be controlled interactively using VAX/VMS syntax style or Motif/X11 from either VAX/VMS or UNIX. The concept of forming more than one program to be a parallel task makes use of the batch queue system of BOSS. Since tasks are formed of modulus, a program can run without any internal changes in an offline or online environment or get its input from other programs as in a simulation by simply replacing some modules. The BOSS system has been under test since spring 1991. (orig.).

20553 (CONF-911103-8) **Graphical development tools for network-based concurrent supercomputing.** Beguelin, A. (Tennessee Univ., Knoxville, TN (United States). Dept. of Computer Science); Dongarra, J.; Geist, A.; Manchek, R.; Sunderam, V. Oak Ridge National Lab., TN (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Contract CCR-8809615. From Conference on supercomputing '91; Albuquerque, NM (United States); 14-16 Nov 1991. Order Number DE92011144. Source: OSTI; NTIS; GPO Dep.

This paper describes an X-window based software environment called HeNCE (Heterogeneous Network Computing Environment) designed to assist scientists in developing parallel programs that run on a network of computers. HeNCE is built on top of a software package called PVM which supports process management and communication between a network of heterogeneous computers. HeNCE is based on a parallel programming paradigm where an application program can be described by a graph. Nodes of the graph represent subroutines and the arcs represent data dependencies. HeNCE is composed of integrated graphical tools for creating compiling executing and analyzing HeNCE programs.

20554 (CONF-920466-6) **Process simulation in waste management.** Ferrada, J.J. (Oak Ridge National Lab., TN (United States)); Jackson, J.R.; Leach, P.V. Oak Ridge National Lab., TN (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992. Order Number DE92011677. Source: OSTI; NTIS; GPO Dep.

Waste minimization is an important component of any organization's waste management program and is being increasingly demanded by upper management. The major objective of waste minimization is to reduce the amount of waste, the hazard of waste, or the difficulty in managing the waste by modifying raw materials, feed preparation, and the generating process, or altering effluent streams. Thus, waste management process simulation programs are a real necessity for conducting appropriate analyses of the existing processes that produce waste or modifying the existing processes to diminish waste production. This paper discusses the simulation package being developed at Oak Ridge National Laboratory. An effort to develop a new simulation package has started at ORNL in the Chemical Technology Division. The purpose of developing this package is to make it available to all DOE installations for their own use in waste management and process analysis. One of the necessary features of the simulation package is user friendliness. User friendliness, for the development of this program is understood as a characteristic of the computer program that provides easy access to the process unit operations, a simple question-answer interface for data input, and straightforward program execution commands.

20555 (CONF-9204106-3) **HeNCE: Graphical development tools for network-based concurrent computing.** Beguelin, A. (Oak Ridge National Lab., TN (United States)); Dongarra, J.; Geist, A.; Manchek, R.; Moore, K.; Wade, R.; Sunderam, V. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-91ER25105. CCR-8809615. From Scalable high performance computing conference; Williamsburg, VA (United States); 26-29 Apr 1992. Order Number DE92011061. Source: OSTI; NTIS; GPO Dep.

HeNCE (Heterogeneous Network Computing Environment) is an X Window based graphical parallel programming environment that was created to assist scientists and engineers with the development of parallel programs. HeNCE provides a graphical interface for creating, compiling, executing, and debugging parallel programs, as well as configuring a distributed virtual computer (using PVM). HeNCE programs can be run on a single Unix workstation or over a network of heterogeneous machines. This paper describes the purpose and use of the HeNCE software.

20556 (CONF-9206152-1-Extd.Abst.) **Driving a car with custom-designed fuzzy inferencing VLSI chips and boards.** Pin, F.G.; Watanabe, Y. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CESAR-92/11A). From 1992 international joint technology workshop on fuzzy logic and neural networks; Houston, TX (United States); 1-3 Jun 1992. Order Number DE92011688. Source: OSTI; NTIS; GPO Dep.

Short communication. AUTOMOBILES/computerized control systems; COMPUTERIZED CONTROL SYSTEMS/fuzzy logic; INTEGRATED CIRCUITS; AUTOMOBILES; ARTIFICIAL INTELLIGENCE; NAVIGATION; NEURAL NETWORKS

20557 (DOE/ER/25024-2) **Mathematical software for ODEs: Final technical report.** Shampine, L.F. Southern Methodist Univ., Dallas, TX (United States). [1989]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER25024. Order Number DE92010660. Source: OSTI; NTIS; GPO Dep.

Short communication. DIFFERENTIAL EQUATIONS/runge-kutta method; PROGRESS REPORT; COMPUTER CODES

20558 (DOE/ER/25105-1) **Network based high performance concurrent computing: Progress report, [FY 1991].** Sunderam, V.S. Emory Univ., Atlanta, GA (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER25105. Order Number DE92011939. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this project are to investigate research issues pertaining to programming tools and efficiency issues in network based concurrent computing systems. The basis for these efforts is the PVM project that evolved during my visits to Oak Ridge Laboratories under the DOE Faculty Research Participation program; I continue to collaborate with researchers at Oak Ridge on some portions of the project.

20559 (DOE/SA-0006) **Virtual Memory System (VMS) system security guideline.** USDOE Office of Security Affairs, Washington, DC (United States). Apr 1992. 44p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92013694. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The VAX/VMS environment provides unique built-in security control features for implementation by a system administrator. However, if the necessary controls are not in place, any or all of the VAX/VMS security mechanisms can be easily bypassed. The following sections describe the primary set of security controls available for version 4 Virtual Memory Systems (VMS). This document attempts to cover the most important aspects of VMS security. Section 3 provides a checklist summarizing the primary topics covered in this document for use by experienced system administrators. Section 4 describes those areas considered of primary importance for security of every type of system. Section 5 provides information on additional security concerns that could be useful for some systems, depending on the operating environment. Section 5 also includes information on the additional VMS control needed to meet the Department of Defense C2 rating and DEC security updates. The list of references given in section 6 provide further information on VMS security. Where applicable, the necessary controls needed to meet the minimum security requirements defined in the Department of Energy Order 5637.1 are included. The term system administrator is used throughout the document to refer to the person who implements the commands contained in this guide. It is assumed that the system administrator is a system manager or security officer since system privileges are required to execute many of the commands in this guide.

20560 (EGG-10617-6085) **An alternative to sneakernet.** Orrell, S.; Ralstin, S. EG and G Energy Measurements, Inc., Albuquerque, NM (United States). Kirtland Operations. [1992]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. (CONF-9205130-1: DOE computer security group conference, Las Vegas, NV (United States), 4-7 May 1992). Order Number DE92011146. Source: OSTI; NTIS; GPO Dep.

Many computer security plans specify that only a small percentage of the data processed will be classified. Thus, the bulk of the data on secure systems must be unclassified. Secure limited access sites operating approved classified computing systems sometimes also have a system ostensibly containing only unclassified files but operating within the secure environment. That system could be networked or otherwise connected to a classified system(s) in order that both be able to use common resources for file storage or computing power. Such a system must operate under the same rules as the secure classified systems. It is in the nature of unclassified files that they either came from, or will eventually migrate to, a non-secure system. Today, unclassified files are exported from systems within the secure environment typically by loading transport media and carrying them to an open system. Import of unclassified files is handled similarly. This media transport process, sometimes referred to as sneaker net, often is manually logged and controlled only by administrative procedures. A comprehensive system for secure bi-directional transfer of unclassified files between secure and open environments has yet to be developed. Any such secure file transport system should be required to meet several stringent criteria. It is the purpose of this document to begin a definition of these criteria.

20561 (EGG-HFRU-10026) **Representing cognitive activities and errors in HRA trees.** Gertman, D.I. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 15p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States).

DOE Contract AC07-76ID01570. Order Number DE92012358. Source: OSTI; NTIS; INIS; GPO Dep.

A graphic representation method is presented herein for adapting an existing technology–human reliability analysis (HRA) event trees, used to support event sequence logic structures and calculations–to include a representation of the underlying cognitive activity and corresponding errors associated with human performance. The analyst is presented with three potential means of representing human activity: the NUREG/CR-1278 HRA event tree approach; the skill-, rule- and knowledge-based paradigm; and the slips, lapses, and mistakes paradigm. The above approaches for representing human activity are integrated in order to produce an enriched HRA event tree – the cognitive event tree system (COGENT)– which, in turn, can be used to increase the analyst's understanding of the basic behavioral mechanisms underlying human error and the representation of that error in probabilistic risk assessment. Issues pertaining to the implementation of COGENT are also discussed.

20562 (EGG-NE–10137) **VENTURE/PC manual: A multidimensional multigroup neutron diffusion code system: Version 3.** Shapiro, A. (Cincinnati Univ., OH (United States)); Huria, H.C.; Cho, K.W. EG and G Idaho, Inc., Idaho Falls, ID (United States); Cincinnati Univ., OH (United States). Dec 1991. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012361. Source: OSTI; NTIS; GPO Dep.

VENTURE/PC is a recompilation of part of the Oak Ridge BOLD VENTURE code system, which will operate on an IBM PC or compatible computer. Neutron diffusion theory solutions are obtained for multidimensional, multigroup problems. This manual contains information associated with operating the code system. The purpose of the various modules used in the code system, and the input for these modules are discussed. The PC code structure is also given. Version 2 included several enhancements not given in the original version of the code. In particular, flux iterations can be done in core rather than by reading and writing to disk, for problems which allow sufficient memory for such in-core iterations. This speeds up the iteration process. Version 3 does not include any of the special processors used in the previous versions. These special processors utilized formatted input for various elements of the code system. All such input data is now entered through the Input Processor, which produces standard interface files for the various modules in the code system. In addition, a Standard Interface File Handbook is included in the documentation which is distributed with the code, to assist in developing the input for the Input Processor.

20563 (ENEA-RT-INN–90-31) **Biunitary transformation and ordinary differential equations (part 2).** Dattoli, G.; Mari, C.; Torre, A.; Loreto, V.; Richetta, M. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione. Mar 1991. 31p. (RT/INN–90-31). Order Number DE92506269. Source: OSTI; NTIS (US Sales Only).

The results of a recent reformulation of the theory of arbitrary order differential equations in terms of non-Hermitian operators is used to show that the invariant binorm is associated to a generalized Courant-Snyder invariant. Furthermore, the existence of higher order invariants associated to the Casimir operators of the group is indicated, utilized to treat higher order equations. The intrinsic super symmetric nature of the theory developed is also discussed. Finally, the relevance of the proposed mathematical technique to the design of fibre optics transport systems is showed.

20564 (ENEA-RT-INN–90-34) **Study of electromagnetic fields in electron RFQ structure.** Picardi, L.; Raimondi, P.; Ronsivalle, C. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione. May 1991. 14p. (RT/INN–90-34). Order Number DE92506266. Source: OSTI; NTIS (US Sales Only).

The increasing interest in high brightness electron injectors, especially in regard to FEL applications, get to study the feasibility of a RFQ (Radio Frequency Quadrupole) for electrons. In this paper, the correct electromagnetic fields are derived for a structure where it is no longer possible to use the T-K electrostatic approximation because the beam aperture is not much smaller than the wavelength.

20565 (ETDE-IT–92-38) **Parametrizing free electron laser physics.** Dattoli, G.; Fang, H.; Giannessi, L.; Mezi, L.; Torre, A.; Caloi, R. ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione; Rome Univ. (Italy). 1991. 39p. (CONF-910249–2: International topical conference on research trends in coherent radiation generation and particle accelerators, La Jolla, CA (United States), 11-13 Feb 1991). Order Number DE92506264. Source: OSTI; NTIS (US Sales Only).

The free electron laser is a rather complicated device, its performance depends indeed on a large number of parameters and on the interplay between them. This note shows how an accurate choice of such parameters along with a suitable combination of them can be helpful to derive scaling laws relevant to e.g. the gain or output power. Such a view allows a kind of unitary description of the various effects occurring in free electron laser physics. In particular, the gain depression induced e.g. by the electron-beam energy spread is the same as that due to a finite width of the optical pulse.

20566 (FNAL-TM–1773) **Network load of X terminals at CDF.** Abar, F.; O'Reilly, C.; Wicklund, E. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE92011704. Source: OSTI; NTIS; GPO Dep.

As an aid to planning future usage of X terminals, the authors measured the network bandwidth used by X terminals on a single Ethernet in a typical application environment at Fermilab. The objectives were twofold. The first objective was to identify the impact of adding one more X terminal onto the CDF Ethernet . The second objective was to determine the maximum number of X terminals allowable on the CDF network. The findings reveal that an X terminal in this environment used, on average, 431 + /–45 bytes/second. This is quite small compared to the utilizable bandwidth of the thinwire Ethernet network (375 Kilobytes/second, equivalent to 30% of total bandwidth). This amounts to an averaged load of .034% on the network per X terminal. This paper addresses the network load solely. It does not address the loads imposed by X terminals on the memory and CPU of the host systems.

20567 (KCP–613-4742) **Help may be on the way, IEEE standard P1209: The recommended practice for the evaluation and selection of CASE tools.** Lackner, M.F.; Grice, J.V. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Nov 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9205128–2: Symposium on assessments of quality software development tools, New Orleans, LA (United States), 27-29 May 1992). Order Number DE92011343. Source: OSTI; NTIS; GPO Dep.

This paper explores what has transpired in the world of standards, specifically dealing with the Institute of Electrical and Electronic Engineers (IEEE) standard, P1209. This standard (currently in draft form) is concerned with the evaluation and selection of Computer Aided Software Engineering (CASE) tools. The formal title of the standard is The Recommended Practice for the Evaluation and Selection of CASE Tools. Additionally, a brief CASE tool philosophy is presented as introductory material and background information for this standard. The reasoning behind the ancillary information is to put CASE tools in their proper perspective within the software development and maintenance life cycles.

20568 (KIYaI–89-18) **A subroutine for calculation of γ-ray response function in the stilbene scintillators 30x30; 50x50 and 70x30 mm in the range E 1.5-10 MeV.** Gajdaenko, S.A.; Kadkin, E.P.; Shevchenko, S.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1989. 14p. (In Russian). Order Number DE92627147. Source: OSTI; NTIS (US Sales Only); INIS.

A subroutine for calculation of γ-ray response function in the stilbene scintillators 30x30, 50x50, 70x30 mm in the range E_γ1.5-10 MeV is presented. 6 refs.; 5 figs.

20569 (KIYaI–90-14) **On application of maximum entropy principle for restoring a radiation sources distribution.** Tokarevskij, V.V.; Shevchenko, S.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 13p. (In Russian).

Order Number DE92627148. Source: OSTI; NTIS (US Sales Only); INIS.

The distribution restoring by maximum entropy method (MEM) is tested for radiation sources distribution. The radiation values are determined by means of maximization of likelihood function and entropy of distribution in question. The computer simulation was used. It is found that a dispersion of ME-estimate and a dispersion of full a priori information estimate are practically equal. 9 refs.; 5 tabs.

20570 (KIYal–90-21) **To the problem on the algorithm of radiation source detection on stationary noise.** Tokarevskij, V.V.; Shevchenko, S.V. AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij. 1990. 15p. (In Russian). Order Number DE92627149. Source: OSTI; NTIS (US Sales Only); INIS.

A number of criterions for a problem of radiation source detection on stationary noise by analysis of computer simulation time series data is investigated. The data have Poisson distribution. It is found, that criterion using maximum entropy estimation of radiation source distribution is more efficient then conventional one using maximum likelihood estimations. 7 refs.; 2 tabs.

20571 (LA-UR–92-805) **On the abstracted dataflow complexity of Fast Fourier Transforms.** Boehm, A.P.W. (Colorado State Univ., Fort Collins, CO (United States). Dept. of Computer Science); Hiromoto, R.E.; Kelly, K.A.; Ashley, J.M. Los Alamos National Lab., NM (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920730–3: ACM SIGARCH international conference on supercomputing, Washington, DC (United States), 19-24 Jul 1992). Order Number DE92011372. Source: OSTI; NTIS; GPO Dep.

In this paper we develop and analyze the simulated performance of codes for the Fast Fourier Transform written in If and targeted for execution on Motorola's dataflow machine Monsoon. The FFT application is of interest because of its computational parallelism, its requirement for global communications, and its array element data dependences. We use the parallel profiling simulator Id World to study the dataflow performance of various implementations. Our approach is comparative. We study two approaches, a recursive and an iterative one, and in each version we examine the effect of a variety of implementations. We contend that only through such comparative evaluations can significant insight be gained in understanding the computational and structural details of functional algorithms.

20572 (LA-UR–92-829) **Reconstruction based on flexible prior models.** Hanson, K.M. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920298–1: 6. SPIE conference on medical imaging, Newport Beach, CA (United States), 23-28 Feb 1992). Order Number DE92011263. Source: OSTI; NTIS; GPO Dep.

A new approach to Bayesian reconstruction is introduced in which the prior probability distribution is endowed with an inherent geometrical flexibility. This flexibility is achieved through a warping of the coordinate system of the prior distribution into that of the reconstruction. This warping allows various degrees of mismatch between the assumed prior distribution and the actual distribution corresponding to the available measurements. The extent of the mismatch is readily controlled through constraints placed on the warp parameters.

20573 (LA-UR–92-1048) **A dynamic menuing and security system.** Koon, D.M.; Zowin, J.A. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205138–1: North American Ingres Users Association (NAIUA) meeting, Tarpan Springs, FL (United States), May 1992). Order Number DE92011229. Source: OSTI; NTIS; GPO Dep.

Commonly, a system creator will seek to limit access to various parts of an information system based on the user is and what authorities should be granted that person. With a payroll system, it would be expected that only a limited number of people would be able to change data, a larger segment of managers would be able to view information on their particular department, and perhaps everyone would be able to see their own information. This sort of situation presents an interesting problem for the system designer who would like to minimize the amount of coding necessary to accomplish this level of flexibility and to simplify maintenance of the application system. We were presented with such a problem with a project accounting system. The two first implementations of this application system were based on simply locking users out of screens for which they had no authority. A polite message was displayed indicating that the user did not have authority to access the screen in question. This method had the potential of becoming a security problem because the code was replicated in each of fifteen menus. Changes had to propagated around several different menus for several different levels of authorization. This created difficulty for us in maintaining a consistent set of key strokes throughout the system. Exceptions had to be handled via replicated code. These problems led us to re-evaluate the existing system and to create a system based on the following set of user requirements: access to functions must be based on the user's level of authority; all menus should require the basic keystrokes; menus to which a user dose not have authority should not be displayed to that user; and finally, so-called "super users" must be able to access data from the point of view of various sub-organizations.

20574 (M–276-Rev.1) **PANACEA User's Manual: Revision 1.** Brown, S.A. Lawrence Livermore National Lab., CA (United States). 16 Dec 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011289. Source: OSTI; NTIS; GPO Dep.

A numerical simulation code is fundamentally a device to solve an initial value problem. Very often these programs are written starting with the routines that solve some system of equations. Unless care is taken to formulate these routines with regard to a host of issues it can be very awkward to set up a problem or to look at the answers that the code returns. Furthermore, it can be nearly impossible to take advantage of some of the excellent work that various groups have done because the data flow and structuring issues have not been given sufficient attention in the program design stages. One way to avoid some of these difficulties is to write the data flow controls, the I/O mechanisms, and the database manager first. With these parts in place, there is a great deal of guidance for building the parts of a simulation code that deal with the specific set of equations to be solved; thus initial value data is fed in and the solution is written out clearly and conveniently. Furthermore, this approach provides a basis for defining some conventions to allow the sharing of simulation modules. It also helps isolate the machine dependencies of a code in a very few places, which greatly enhances the portability of the code. PANACEA is a library of routines built to address these issues. In essence, PANACEA attempts to embody all of the functionality of a numerical simulation code, which is generic to all simulation codes. It accomplishes this by implementing a model of the simulation as a system of services, which are bound together with the simulation specific routines provided by the code developer. One useful result of this approach is that it effectively imposes a discipline for the development of simulation codes that promote shareability, portability, and inter-operability.

20575 (NEI-NO–202) **Extrapolation methods for ordinary differential equations (ODE): continuous approximations, a parallel approach.** Simonsen, H.H. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1990 88p. Order Number DE92506528. Source: OSTI; NTIS (US Sales Only).

This thesis consists of the following three papers: Continuous approximations for extrapolation methods; Views on the solution of ordinary differential equations (ODE) on parallel computers; A parallel ODE solver based on extrapolation. The first paper presents ways of constructing interpolants for extrapolation methods in ODE's. Extrapolation based on the forward Euler and smoothed midpoint rule are examined in detail. The same schemes can be utilized both for extrapolation based on the backward Euler rule and for extrapolation based on any symmetric two-step method. The next paper discusses the use of parallel computers for solving ODE's. This paper attempts to identify some ODE problems that are good candidates for parallel execution. The third paper presents some experiments done with a parallel ODE solver based on extrapolation. These experiments were conducted on a two-processor CRAY computer. The work may have practical applications in fields like process simulation and control systems. 62 refs., 14 figs., 7 tabs.

20576 (ORNL/TM–11553) **Description of the National Highway Planning Network.** Peterson, B.E. Oak Ridge National Lab., TN (United States). Sep 1990. 29p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012414. Source: OSTI; NTIS; GPO Dep.

The National Highway Planning Network is a data base of major highways in the continental United States. It is a foundation for analytic studies of highway performance, for vehicle routing and scheduling problems, and for mapping purposes. The network is based on a set of roadways digitized from the National Atlas by the US Geological Survey. It has been enhanced at Oak Ridge National Laboratory by adding additional roads and attribute detail and correcting topological errors to produce a true analytic network. This documentation is intended primarily to assist users of this data base by describing its structure, data elements, and development.

20577 (ORNL/TM–11938, pp. 1-8) **Robotic mobility and cognitive maps.** Benda, C.M. (IBM, Charlotte, NC (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

This paper focuses on the acquisition and storage of environmental information by a mobile robot. The environment includes obstacles which must be mapped by the robot. A method for representing a robot moving through its environment is described. Algorithms used for storage and retrieval of environmental data are presented. The goal is to represent the data in what is known as a cognitive map which allows faster retrieval of the environmental data because of this representation's compact nature.

20578 (ORNL/TM–11938, pp. 9-20) **A quantitative analysis of reasoning for RMS.** Buisson, L.; Euzenat, J. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

For reasoning systems, it is sometimes useful to cache away the inferred values. Meanwhile, when the system works in a dynamic environment, cache coherence has to be performed, and this can be achieved with the help of a reasoning maintenance system (RMS). The questions to be answered, before implementing such a system for a particular application, are: how much is caching useful? Does the system need a dynamicity management system? Is a RMS suited (what will be its overhead)? The authors provide an application driven evaluation framework in order to answer these questions. The evaluation is based on the real work to be processed on the reasoning of the application. First, they express the action of caching and maintaining with two concepts: backword and forward cone effects. Then they quantify the inference time for those systems and find the quantification of the cone effects in the formulas.

20579 (ORNL/TM–11938, pp. 33-44) **Integrated reasoning through associative retrieval.** Eskridge, T. (New Mexico State Univ., Las Cruces (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Traditional research in machine learning has taken a componential view of reasoning where deduction, induction, and analogy are studied separately with a different computational mechanism proposed for each. The author has designed and implemented a computational model in which small variations on a single mechanism, associative retrieval, can perform deductive, inductive and analogical reasoning. Similar notions of using a uniform mechanism to perform the three reasoning tasks have been proposed. His notion differs from these in that he employs the principles embodied in the Continuous Analogical Reasoning theory to constrain and focus what is retrieved, ensuring the retrieval of the most relevant, useful information available. This paper begins with a discussion of Continuous Analogical Reasoning, motivating the need for interactions between the stages of analogy and comparing it to Discrete Analogical Reasoning. It then describes the hybrid symbolic-connectionist knowledge representation and processing mechanisms of the ASTRA program. It is the unique combination of structure and processing in ASTRA which allows the complex, continuous interactions to take place among all stages of the analogical reasoning process. The system's behavior under different forms of reasoning is then discussed, which shows success in achieving integrated reasoning and provides impetus for future research.

20580 (ORNL/TM–11938, pp. 45-55) **A first order theory for representing space in knowledge-based scene generation.** Giunchiglia, E. (Univ. of Genoa (Italy)); Armando, A. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The key idea of the work described in this paper is to use a declarative representation of space (based on first order logic) as well as a procedural one (based on a semantic network). The link between the two representation is made by semantic attachment, defining the semantic network to be the intended model of the first order theory. The paper describes how the author has modeled space, both syntactically and semantically.

20581 (ORNL/TM–11938, pp. 57-64) **Learning intermediate concepts in causal trees: A direct method.** Golmard, J. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The author proposes an empirical but a direct method used to learn partially unknown causal tree structures. More specifically, he supposes that the intermediate layer of a three-layered causal tree is completely unknown. A set of examples where the root node and the bottom layer nodes are observed is available. The principle of the method is to compute a correlation matrix which is block diagonal according to the model. This structure is then found using a clustering algorithm. A simulation experiment highlights the potential usefulness of the method in practical situations. Finally, open problems are briefly reviewed.

20582 (ORNL/TM–11938, pp. 65-72) **Transformation-ordering iterative-deepening-A*.** Hall, L.O. (Univ. of South Florida, Tampa (United States)); Cook, D.J.; Thomas, W. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Iterative-Deepening-A* (IDA*) is an optimal search technique which requires no intermediate state storage. It is suitable for large search spaces. It uses a fixed order for the children of a node to be expanded. Transformation-Ordering Iterative-Deepening-A* (TOIDA*) attempts to improve upon the performance of IDA* by dynamically improving the order nodes are expanded, based on results from previous depth limits. Using the Fifteen puzzle as an example, it is shown that TOIDA* may choose the optimal fixed ordering and generally chooses a good ordering saving a substantial number of node expansions. Empirical results show that the sequential version can provide significant improvements in the speed with which a solution is discovered and no penalty in storage requirements.

20583 (ORNL/TM–11938, pp. 73-82) **An improvement of weighting strategy in resolution-based automated reasoning.** Yonggi Kim (Florida State Univ., Tallahassee (United States)); Kohout, L.J. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Resolution theorem prover systems form an important category of logical architectures in the field of Automated Reasoning. In this paper the authors outline a method for control of inferential strategies of resolution based architectures which employs the triangle fuzzy relational products and fast fuzzy relational algorithms. The method for speeding up the logical inference is tested in conjunction with the theorem prover called ITP. The fast fuzzy algorithm is used in resolution based automated reasoning to produce the weights of terms automatically. By using the weights extracted by the fast fuzzy algorithm, some of the fuzzy implication operators were compared.

20584 (ORNL/TM–11938, pp. 83-94) **Pattern recognition using the third and the fifth classes of dynamical systems.** Ying Liu (Savannah State Coll., GA (United States)); Hede Ma. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

In this paper, dynamical systems are classified into eight classes by the authors. Thereafter, efficient methods are developed in this paper to recognize an input vector using the third and the fifth classes of dynamical systems defined by the authors. Patterns classified and recognized by a dynamical system are based on attractors of the system. Wolfram's cellular automata, Barnsley's iterated function systems (IFS), and ω-Orbit Finite automata proposed by the authors are used to illustrate the idea that how patterns can be recognized by the third and the fifth classes of dynamical systems, which is a more efficient approach than the existing methods.

20585 (ORNL/TM–11938, pp. 95-106) **Sensory integration.** McKee, G.T. (Univ. of Reading (United Kingdom)); Powner, E.T. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Technology is moving slowly but surely towards the age of multisensor machines. Primitive versions of such machines have been around for some time. Primitive, that is, when compared to human beings, for they do not possess the full complement of sensors possessed by human beings, and the sensors they do possess are only a shadow of their human counterparts. Industrial robots are the typical example. The primitive character of these machines is reflected in the lack of any detailed theory of sensory systems, or indeed of any systematic methodology for engineering their sensory mechanisms. Of course, given their primitive nature, a detailed theoretical understanding is obviously of little importance, and likewise an engineering methodology. However, as technology moves towards more sophisticated sensory machines, and as the demand for the correct and efficient engineering of these machine increases, the need for this theory and methodology becomes both obvious and urgent. This paper is concerned with the integration of sensory data drawn from a heterogeneous set of sensors. A basic architecture for the sensory subsystem of an intelligent machine is developed, single modality and multiple modality sensory information processing are introduced, three levels are identified for sensory integration (single sensor, multiple sensor and multiple modality) and the forms of sensory integration required at each level are introduced and discussed.

20586 (ORNL/TM–11938, pp. 107-117) **Data structures + genetic operators = evolution programs.** Michalewicz, Z. (Univ. of North Carolina, Charlotte, (United States)); Schell, J.; Seniv, D. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

This paper discusses a new approach for solving constrained optimization problems using nonstandard genetic algorithms. The authors call this approach: evolution programming. They argue that a natural representation of a solution for a given problem plus a family of applicable genetic operators might be quite useful in the approximation of solutions of constrained optimization problems. They describe some experiments of using this approach.

20587 (ORNL/TM–11938, pp. 119-130) **Generic problem solving models in a computer-aided methodology for the construction of knowledge based systems.** Probst, A.R. (Univ. of Lausanne (Switzerland)); Horvitz, A.I.; Wenger, D. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

This paper describes a Computer Aided Knowledge Engineering (CAKE) tool that embodies a development methodology specially suited for the construction of knowledge based systems. The computer based tool also includes a library of predefined problem solving models called G-TECS (Generic Techniques). Categories of G-TECS are defined as classes and are organized in hierarchies. The inheritance and instanciation mechanism substantially ease the generation of specific applications. Reusability of predefined models is supported at a broad level.

20588 (ORNL/TM–11938, pp. 131-142) **Generation of production rules of backward search from neural networks.** Du Qun Qian (Olivetti Artificial Intelligence Center, Ivrea (Italy)); Scaruffi, P.; Russi, D. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The rapid development of neural networks has attracted much attention of AI researchers. However, compared with the advantages that symbolic representations of knowledge in AI systems can be stated in a clear and relatively simple way, and can be easily documented, explained, taught and learned, neural networks have some disadvantages., i.e., the neural networks fail to offer an explanation function to the users. The users nearly always want to know why a neural network comes up with a particular answer. Sometimes they try to learn how the neural network makes decisions so that they can improve their own understanding of the problems; sometimes they want to verify that the neural network is working correctly. Therefore, by integrating neural networks with AI systems, the realization of some connectionist systems in different application areas have proven the viewpoint, i.e., the connectionist systems are more powerful than either of neural networks and AI systems. In order to overcome the above disadvantages of neural networks, this paper studies the generation of explicit representation of knowledge, namely, knowledge acquisition, from neural networks and explanation of the conclusions inferred by neural networks. In this paper, some heuristic backword search strategies for generating production rules and presenting some explanations to users are proposed.

20589 (ORNL/TM–11938, pp. 143-153) **Computational nonmonotonism and the qualification problem.** Rajasekar, A. (Univ. of Kentucky, Lexington (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of* *the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Human beings isolate qualification checking from general problem solving and do not check for all qualifications all the time. But, they are prepared to allow erroneous conclusions in favor of exhaustive checking. A strategy which has these human traits can be accepted as a possible solution for the qualification problem. In this paper the author develops a strategy, called computational nonmonotonism (CN), which mimics the above paradigm. In a CN system a qualification is applied only if it is relevant to a context or if it has a priority greater than a certain level warranted by the situation or scenario. The conclusions from a scenario can be different from another because of different qualifications which become applicable depending on the scenario. He applies computational nonmonotonism to a system of rules and qualifications and provide declarative and operational semantics for inferring from the system. He also shows the generality of the approach, by applying the computational nonmonotonism technique to default reasoning and circumscription. The three applications capture differing intuitions of computational nonmonotonism. He also points out that the approach can be adapted for real-time, time-constrained nonmonotonic reasoning.

20590 (ORNL/TM-11938, pp. 155-166) **Task allocation by a team of learning automata.** Seredynski, F. (Polish Academy of Sciences, Warsaw (Poland)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR-91/32;CONF-9110260-: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

As computer architectures evolve towards massive parallelism, a major research question that has developed is the question of assigning modules of a program into a parallel computer for maximum performance. The problem belongs to a class of combinatorial optimization problems and is known as NP-complete. Various techniques have been treated lately for possible solutions. These solutions are based on application of mathematical programming, graph theory, branch and bound algorithms, or queuing theory. In this paper, parallel algorithm of static allocation of a program into parallel computer is proposed. The algorithm is seen as a sequence of games of learning automata team migrating in a computer system graph.

20591 (ORNL/TM-11938, pp. 167-177) **Notes on rough inference.** Shay, B. (Hunter Coll., New York, New York, (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR-91/32;CONF-9110260-: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The author proposes a general strategy for defining theories of non-monotonic inference, and a particular theory for use in connection with methods for modeling uncertain belief and reasonable action. Although non-monotonic inference is defined without reference to subjective probability, my methods for modeling uncertain belief and reasonable action are based on subjective probability. He can guarantee that the lottery paradox will not arise in application of the particular theory in connection with these methods.

20592 (ORNL/TM-11938, pp. 191-202) **Inheritance in conceptual networks.** Leixuan Yang, (Univ. of Ottawa, Ontario, (Canada)); Szpakowicz, S. Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR-91/32;CONF-9110260-; 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The authors present the inheritance system in a knowledge representation formalism called Conceptual Network. Exceptions can be represented in this formalism by means of conditions attached to conceptual relations. The explicit representation of exceptions allows one to implement monotonic inference for the inheritance problem. They look at the way in which their inheritance system works on some of the classical examples. This system offers a new approach to the inheritance problem, with a new representation method and a simple monotonic inference algorithm.

20593 (ORNL/TM-11938, pp. 203-214) **Combining symbolic and numeric representations in learning flexible concepts: The FCLS system.** Jianping Zhang (Utah State Univ., Logan (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR-91/32;CONF-9110260-: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

Many current methods of learning concepts from examples assume that concepts are precise entities, representable by a pure symbolic representation, and that concept examples are equally representative. Human concepts, however, are often flexible. They inherently lack precisely defined boundaries and have a central tendency, and their meaning is often context-dependent. Examples of these concepts are usually not all equivalent. This paper describes an approach to learning flexible concepts from examples. In this approach, a novel hybrid representation was introduced to represent flexible concepts. This hybrid representation is a combination of symbolic and numeric representations. An associate inductive learning algorithm was also represented. This approach was implemented in the Flexible Concept Learning System (FCLS) and tested on three different types of problems: the problems favorable for FCLS, the problems unfavorable for FCLS, and real world problems. The experimental results showed a strong support for the proposed flexible concept learning method.

20594 (ORNL/TM-12065) **Kendall Square multiprocessor: Early experiences and performance.** Dunigan, T.H. Oak Ridge National Lab., TN (United States). Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92013351. Source: OSTI; NTIS; GPO Dep.

Initial performance results and early experiences are reported for the Kendall Square Research multiprocessor. The basic architecture of the shared-memory multiprocessor is described, and computational and I/O performance is measured for both serial and parallel programs. Experiences in porting various applications are described.

20595 (PNL-7511-Ver.1.0) **Solid waste projection model: Database user's guide (Version 1.0).** Carr, F.; Stiles, D. Pacific Northwest Lab., Richland, WA (United States). Jan 1991. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE91007890. Source: OSTI; NTIS; INIS; GPO Dep.

The Solid Waste Projection Model (SWPM) system is an analytical tool developed by Pacific Northwest Laboratory (PNL) for Westinghouse Hanford Company (WHC) specifically to address Hanford solid waste management issues. This document is one of a set of documents supporting the SWPM system and providing instructions in the use and maintenance of SWPM components. This manual contains instructions for preparing to use Version 1 of the SWPM database, for entering and maintaining data, and for performing routine database functions. This document supports only those operations which are specific to SWPM database menus and functions, and does not provide instructions in the use of Paradox, the database management system in which the SWPM database is established. 3 figs., 1 tab.

20596 (PNL-SA-17467) **Developments in computation, modeling and experimentation: Impacts on R&D.** Young, J.K. Pacific Northwest Lab., Richland, WA (United States). Oct 1989. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-8910571-1: ALCOA technical symposium on opportunities for computer science to advance materials science, Pittsburgh, PA (United States), 15-17 Oct 1989). Order Number DE92012351. Source: OSTI; NTIS; GPO Dep.

The original objective was to document the feasibility of the coordinated research program sponsored by ECUT called "Materials-by-Design (MBD)." The MBD program funds research to develop hierarchical models to predict materials' performance based on microstructural information. This paper was specifically prepared for this meeting to help technical staff and their managers justify and plan for an advanced computer infrastructure within their companies. In order to do this, several additional objectives for this paper are (1) to foster an appreciation of the dramatic increase in computational power that have occurred over the last forty years, (2) to encourage better utilization of supercomputing in current scientific research by identifying current issues and opportunities, and (3) to promote anticipation and enthusiasm for the dramatic changes supercomputers currently being developed will offer scientists in the near future.

20597 (SAND-89-2370) **RADTRAN 4: User guide: Volume 3.** Neuhauser, K.S. (Sandia National Labs., Albuquerque, NM (United States)); Kanipe, F.L. Sandia National Labs., Albuquerque, NM (United States). Jan 1992. 225p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC-0943). Order Number DE92012281. Source: OSTI; NTIS; INIS; GPO Dep.

RADTRAN 4 is used to evaluate radiological consequences of incident-free transportation, as well as the radiological risks from vehicular accidents occurring during transportation. This User Guide is Volume 3 in a series of four volume of the documentation of the RADTRAN 4 computer code for transportation risk analysis. The other three volumes are Volume 1, the Executive Summary; Volume 2, the Technical Manual; and Volume 4, the Programmer's Manual. The theoretical and calculational basis for the operations performed by RADTRAN 4 are discussed in Volume 2. Throughout this User Guide the reader will be referred to Volume 2 for detailed discussions of certain RADTRAN features. This User Guide supersedes the document "RADTRAN III" by Madsen et al. (1983). This RADTRAN 4 User Guide specifies and describes the required data, control inputs, input sequences, user options, program limitations, and other activities necessary for execution of the RADTRAN 4 computer code.

20598 (SAND-91-2790C) **A look at the development environment and tools used in a large INGRES ABF application project.** Eaton, M.J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205138-2: North American Ingres Users Association (NAIUA) meeting, Tarpan Springs, FL (United States), May 1992). Order Number DE92012632. Source: OSTI; NTIS; GPO Dep.

The organization of the INGRES ABF developer's environment trends to be an overlooked aspect of the application development process. Very often this environment develops haphazardly over time as deficiencies and new requirements are identified. This paper will describe some of the problems encountered and the solutions devised. The topics to be discussed are the following: the directory structure used to segregate the multitude of different files required by a large development effort; initialization command procedures for users and developers used to define the various symbols and logical names; file naming conventions; techniques used for configuration management and version control of ABF applications; procedures to assist the developers in quickly switching between the development and production versions of the databases; and tools developed to automate the generation of table and form documentation.

20599 (SAND-91-8230) **The twopnt program for boundary value problems: Version 3.10 of March 1992.** Grcar, J.F. Sandia National Labs., Livermore, CA (United States). Apr 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE92013394. Source: OSTI; NTIS; GPO Dep.

Twopnt is a computer program that finds steady state solutions for systems of differential equations, usually, in one space dimension. This is a guide to the program's use and a description of its operation.

20600 (UCRL-JC-107865) **Solution strategies for implicit nonlinear finite element analysis.** Engelmann, B.E.; Whirley, R.G. Lawrence Livermore National Lab., CA (United States). 8 Aug 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-911213-24: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92011466. Source: OSTI; NTIS; GPO Dep.

The development of effective solution strategies to solve the global nonlinear equations which arise in implicit finite element analysis is an important area of research. Efficient strategies make good use of computational resources, and allow larger and more complex analysis models to be studies. Robust algorithms are essential to handle the complex nonlinearities which arise in many engineering applications, such as metalforming process simulation. Our research indicates that robustness can be best achieved in a general setting through adaptive solution strategies. This adaptivity and flexibility has been incorporated into an implicit nonlinear finite element code, NIKE2D. Temporal and algorithmic adaptivity is achieved through the development of ISLAND (Interactive Solution Language for an Adaptive Nike Driver). These new solution control features make NIKE2D a "smart code," and permit many new and challenging problems to be addressed. 3 refs.

20601 (UCRL-JC-108515) **Detecting intrusions through attack signature analysis.** Snapp, S.R. (Haystack Labs., Inc., Austin, TX (United States)); Mukherjee, B.; Levitt, K.N. Lawrence Livermore National Lab., CA (United States). 11 Oct 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9108194-4: 3. workshop on computer security incident handling, Herndon, VA (United States), 6-8 Aug 1991). Order Number DE92011294. Source: OSTI; NTIS; GPO Dep.

Intrusion detection has generally been based on defining normal user behavior through profiles and rule-based systems and on identifying significant deviations from such behavior as anomalous. An alternative, or a supplementary, strategy for detecting intrusions is based on attack signature analysis, whose objective is to define and recognize events or sequences of events as attack-type behavior. Such event sequences, which may constitute part of a larger attack, may be employed to exploit certain system flaws or known vulnerabilities. This paper concentrates on attack signature analysis in general, and on a preliminary version of the signature analysis module of the distributed intrusion detection system (DIDS) in particular. A signature representation is developed, a number of attack scenarios and their corresponding signatures are outlined, and mechanisms to detect the signatures are discussed.

20602 (UCRL-JC-108548) **The CIAC Binary Inspector Tool (BIT): A nonintrusive vulnerability detection mechanism.** Brown, D.S. Lawrence Livermore National Lab., CA (United States). Oct 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9108194-5: 3. workshop on computer security incident handling, Herndon, VA (United States), 6-8 Aug 1991). Order Number DE92011948. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This paper discusses the problem of detecting and fixing computer operating system and network vulnerabilities. A variety of methods have been tired in the past, and some are still in use these include: creating a specialized team or department and distributing vulnerability notices, conducting security audits, authorizing network attacks under controlled conditions, using intrusive vulnerability analysis tools, and using non-obtrusive vulnerability analysis tools. This paper discusses the advantages of the last approach, and describes an implementation of this approach, the Binary Inspector Tool (BIT). This tool searches compatible host file systems for known vulnerabilities of system binaries. It also displays the best patch or replacement binary to correct the vulnerability, as well as how to obtain the replacement (if possible). In this paper both the design of the BIT tool and directions for future development are also presented.

20603 (UCRL-JC-108973) **Code generation in ALPAL using symbolic techniques.** Cook, G.O. Jr. Lawrence Livermore National Lab., CA (United States). 30 Dec 1991. 11p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920760-2: International symposium on symbolic and algebraic computation, Berkeley, CA (United States), 27-29 Jul 1992). Order Number DE92011299. Source: OSTI; NTIS; GPO Dep.

In practice it takes far more time to program a numerical model than to derive it, especially for a nonlinear model or a model that is approximated by an implicit numerical technique. As part of an effort to simplify this part of the scientist's job, we have created A Livermore Physics Applications Language (ALPAL). ALPAL automatically generates Fortran or C code to numerically solve scientific problems that involve differential and integral equations. The scientist specifies the model and, optionally, the numerical methods with ALPAL using an almost natural language like that used in journal articles. ALPAL is unique in that it can generate highly efficient code, even for the very complicated mathematical problems that arise in large scientific simulation codes. This high level of power is achieved by use of symbolic techniques, including use of computer algebra facilities.

20604 (UCRL-JC-108993) **Does the user interface make interruptions disruptive? A study of interface style and form of interruption.** Storch, N.A. Lawrence Livermore National Lab., CA (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9205143-1: 1992 Association for Computing Machines (ACM) conference on human factor on computer systems, Monterey, CA (United States), 3-7 May 1992). Order Number DE92011295. Source: OSTI; NTIS; GPO Dep.

This experiment examined the influence to the style of the computer user interface on the extent to which performance was decreased by task interruption. Performance on data entry of a personnel database was compared using two different styles of interfaces, under three different forms of interruption. Ten subjects were given a graphical user interface with a mouse and screen buttons; and ten were given a character-based interface with tab and function keys. Interruptions came at unexpected times. Each subject was interrupted three times, once with each form of interruption: telephone call, visitor, and on-screen message. During each interruption, the subject was asked to answer a simple question. The number of fields entered minus the number of fields in error, per minute, was measured during the two-minute post-interruption period. Eye motion data was analyzed in terms of the amount of time and the average durations of eye fixations on the screen. An exit questionnaire solicited the subjects' perceptions of their performance.

20605 (UCRL-JC-109225) **New algorithms for the "minimal form" problem.** Oliveira, J.S. (Lawrence Livermore National Lab., CA (United States)); Cook, G.O. Jr.; Purtill, M.R. Lawrence Livermore National Lab., CA (United States). 20 Dec 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920760-3: International symposium on symbolic and algebraic computation, Berkeley, CA (United States), 27-29 Jul 1992). Order Number DE92011963. Source: OSTI; NTIS; GPO Dep.

It is widely appreciated that large-scale algebraic computation (performing computer algebra operations on large symbolic expressions) places very significant demands upon existing computer algebra systems. Because of this, parallel versions of many important algorithms have been successfully sought, and clever techniques have been found for improving the speed of the algebraic simplification process. In addition, some attention has been given to the issue of restructuring large expressions, or transforming them into "minimal forms." By "minimal form," we mean that form of an expression that involves a minimum number of operations in the sense that no simple transformation on the expression leads to a form involving fewer operations. Unfortunately, the progress that has been achieved to date on this very hard problem is not adequate for the very significant demands of large computer algebra problems. In response to this situation, we have developed some efficient algorithms for constructing "minimal forms." In this paper, the multi-stage algorithm in which these new algorithms operate is defined and the features of these algorithms are developed. In a companion paper, we introduce the core algebra engine of a new tool that provides the algebraic framework required for the implementation of these new algorithms.

20606 (UCRL-JC-109251) **The multicomputer toolbox: Scalable parallel libraries for large-scale concurrent applications.** Skjellum, A.; Baldwin, C. Lawrence Livermore National Lab., CA (United States). 10 Dec 1991. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920730-2: ACM SIGARCH international conference on supercomputing, Washington, DC (United States), 19-24 Jul 1992). Order Number DE92008068. Source: OSTI; NTIS; GPO Dep.

In this paper, we consider what is required to develop parallel algorithms for engineering applications on message-passing concurrent computers. At Caltech, the first author studied the concurrent dynamic simulation of distillation column networks. This research was accomplished with attention to portability, high performance and reusability of the underlying algorithms. Emerging from this work are several key results: first, a methodology for explicit parallelization of algorithms and for the evaluation of parallel algorithms in the distributed-memory context; second, a set of portable, reusable numerical algorithms constituting a "Multicomputer Toolbox," suitable for use on both existing and future medium-grain concurrent computers; third, a working prototype simulation system, Cdyn, for distillation problems, that can be enhanced to address more complex flowsheeting problems in chemical engineering; fourth, ideas for how to achieve higher performance with Cdvn, using iterative methods for the underlying linear algebra. Of these, the chief emphasis in the present paper is the reusable collection of parallel libraries comprising the Toolbox. Concurrent algorithms for the solution of dense and sparse linear systems, and ordinary differential-algebraic equations were developed as part of this work. Importantly, we have embedded the notion of data distribution independence–support for algorithmic correctness independent of data locality choices–into the underlying methodology and practical software. This together with carefully designed message passing primitives, and concurrent data structures encapsulating data layout of matrices and vectors, provides an excellent basis for building and then tuning the performance of whole applications, rather than single computational steps.

20607 (UCRL-JC-109266) **The Matrix Editor for symbolic Jacobians in ALPAL.** Painter, J.F. Lawrence Livermore National Lab., CA (United States). Dec 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920760-1: International symposium on symbolic and algebraic computation, Berkeley, CA (United States), 27-29 Jul 1992). Order Number DE92008076. Source: OSTI; NTIS; GPO Dep.

ALPAL is a Macsyma-based tool that automatically generates code to solve nonlinear integro-differential equations, given a very high-level specification of the equations to be solved and the numerical methods to be used. The Matrix Editor is a graphical, interactive tool for specifying the handling of Jacobian matrices and linear solvers. It automates such routine but difficult tasks as correctly converting from the data structures used for computing the Jacobian to data structures used by a linear solver. The user specifies what to do only at a high, natural level of abstraction.

20608 (UCRL-JC-109496) **PDDP: Data-driven parallelism and shared memory.** Warren, K.H.; Gorda, B.C. Lawrence Livermore National Lab., CA (United States). Dec 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920730-1: ACM SIGARCH international conference on supercomputing, Washington, DC (United States), 19-24 Jul 1992). Order Number DE92008073. Source: OSTI; NTIS; GPO Dep.

The Parallel Data Distribution Preprocessor, PDDP, exploits the cycle time of local shared memory blocks to achieve efficient data parallelization on a MIMD distributed shared memory machine. Shared memory arrays are distributed among the processors. PDDP treats a subset of Fortran D primitives and provides semiautomatic parallelization when Fortran 90 array syntax is used.

20609 (UCRL-JC-109505) **A comparative study of the accuracy of various time domain nonorthogonal mesh methods.** Ray, S.L.; Rambo, P.W. Lawrence Livermore National Lab., CA

(United States). 21 Jan 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920750–1: Institute of Electrical and Electronic Engineers-American Physical Society (IEEE-APS) international symposium, Chicago, IL (United States), 18-25 Jul 1992). Order Number DE92007300. Source: OSTI; NTIS; GPO Dep.

In recent years, a number of researchers have developed numerical methods for solving Maxwell's equations on irregular (nonuniform and nonorthogonal) meshes. These include curvilinear coordinate extensions of the FDTD method, staggered mesh finite volume and discrete surface integration methods, and Voronoi (Dirichlet/Delaunay) mesh methods. Some of these methods are applicable to meshes of quadrilaterals (in 2D), others to triangular grids, and others to either type of element. While all of these methods appear to work well, little is known about their relative accuracy. The standard method for studying the accuracy of discrete wave propagation methods is through dispersion analysis. This type of analysis provides practical information about the accuracy of a given discretization by quantifying the amount of dispersion, dissipation, and anisotropy that is introduced into the solution by the numerical scheme. It also provides a stability limit for the maximum stable time step size. Unfortunately, this analysis can not be applied on an irregular mesh. One can, however,analyze the dispersion characteristics of the uniform nonorthogonal meshes. These skewed meshes present an idealized but representative situation which can be treated analytically, thus providing a simple and powerful means for comparing disparate schemes.

20610 (UCRL-JC–109659) **A task adaptive parallel graphics rendering algorithm.** Whitman, S. Lawrence Livermore National Lab., CA (United States). Dec 1991. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920759–1: Siggraph '92, Chicago, IL (United States), 26-31 Jul 1992). Order Number DE92008062. Source: OSTI; NTIS; GPO Dep.

A parallel approach to computer graphics rendering is needed in order to generate images of highly complex data quickly. This paper presents such an algorithm which can be used on general purpose multiprocessor computers. It was designed for a physically-distributed, logically-shared memory computer with features amenable to both shared memory and message passing implementation. The work decomposition strategy involves assigning rectangular screen space areas to processors initially. Then, as the computation proceeds, processors which have completed their work adaptively partition another processor's task in order to even the computational load. Results on the BBN TC2000 computer at LLNL for this algorithm indicate an efficiency ranging from 59% to 90% on 96 processors for a variety of test images. In fact, a rendering speed of almost 100,000 polygons per second (anti-aliased, specular highlighted) was achieved at this configuration using the software algorithm described here.

20611 (UCRL-JC–109774) **SISAL: Toward resolving the parallel programming crisis.** Cann, D.; Wolski, R.; Feo, J. Lawrence Livermore National Lab., CA (United States). 2 Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920390–2: WHP92 on heterogeneous processing, Beverly Hills, CA (United States), 23-24 Mar 1992). Order Number DE92010716. Source: OSTI; NTIS; GPO Dep.

Sisal (Streams and Iterations in Single Assignment Language) is a functional language for numerical computation on both conventional and novel multiprocessor systems. In this paper, we discuss the Sisal project; illustrate SISAL's performance in comparison to sequential and parallel FORTRAN; and identify the project's future directions. We demonstrate that one can raise the level of program abstraction without sacrificing performance. SISAL programs are efficient, portable, determinate, and free of the burden thwarting parallel program is development. Without question, functional programming can resolve today's parallel programming crisis.

20612 (UCRL-LR–103220-Vol.3) **MGA: A gamma-ray spectrum analysis code for determining plutonium isotopic abundances: Volume 3, FORTRAN listing of the GA code.** Gunnink, R. Lawrence Livermore National Lab., CA (United States). 1 Sep 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92012232. Source: OSTI; NTIS; GPO Dep.

Nondestructive measurements of x-ray and gamma-ray emissions can be used to determine the abundances of various actinides in a sample. Volume 1 of this report describes the methods and algorithms we have developed to determine the relative isotopic abundances of actinides in a sample, by analyzing gamma-ray spectra obtained using germanium detector systems. Volume 2 is a guide to using the MGA (Multiple Group Analysis) computer program we have written to perform plutonium isotopic analyses. This report contains a listing of the FORTRAN instructions of the code.

20613 (UCRL-LR–109666) **A model for/ extending the behavior of annotations.** Garcia, A.M. Lawrence Livermore National Lab., CA (United States). Dec 1991. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011731. Source: OSTI; NTIS; GPO Dep.

This thesis explores the use of Extensible Annotations to assist users in performing procedural tasks described in guideline documents. Extensible Annotations (EA's) are regular annotations with extended properties and functionality. They contain attributes provided by the system or defined by the user; they include links to their anchor document or task, and perhaps to other documents or EA's. All Extensible Annotations are based on an Object-Oriented class hierarchy model, and links between EA's and documents follow a hypertext network model. A prototype implementation of the system has been created for demonstrating the effectiveness of the Extensible Annotational Facility.

20614 (UCRL-MA–108721) **ISLAND: Interactive solution language for an adaptive NIKE driver: User Manual.** Engelmann, B.E.; Whirley, R.G. Lawrence Livermore National Lab., CA (United States). Oct 1991. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92011444. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

Effective solution strategies to solve the global nonlinear equations are a vital part of an implicit nonlinear finite element analysis code such as NIKE2D. Efficient strategies make good use of computational resources, and allow larger and more complex analysis models to be studied. Robust algorithms are essential to handle the complex nonlinearities which arise in many engineering applications, such as metalforming process simulation. Our research indicates that robustness can be best achieved through adaptive solution strategies. This adaptivity and flexibility has recently been incorporated into NIKE2D. Temporal and algorithmic adaptivity is achieved through the development of ISLAND (Interactive Solution Language for an Adaptive Nike Driver). This report serves as a User Manual for the ISLAND language and its application to the definition of adaptive solution strategies in NIKE2D. ISLAND substantially improves the robustness of NIKE2D when solving strongly nonlinear problems. In addition, ISLAND allows new classes of constrained problems to be solved which could not previously be studied. Applications span many process simulation problems, including superplastic forming. These new solution control features make NIKE2D a "smart code," and permit many new and challenging problems to be addressed.

20615 (WSRC-IM–90-83-6) **Reviews of computing technology: Fiber distributed data interface.** Johnson, A.J. Westinghouse Savannah River Co., Aiken, SC (United States). 1 Dec 1991. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92011374. Source: OSTI; NTIS; GPO Dep.

Fiber Distributed Data Interface, more commonly known as FDDI, is the name of the standard that describes a new local area network (LAN) technology for the 90's. This technology is based on fiber optics communications and, at a data transmission rate of 100 million bits per second (mbps), provides a full order of magnitude improvement over previous LAN standards such as Ethernet and Token Ring. FDDI as a standard has been accepted by all major computer manufacturers and is a national standard as defined by the American National Standards Institute (ANSI). FDDI will become part of the US Government Open Systems Interconnection Profile (GOSIP) under Version 3 GOSIP and will become an international standard promoted by the International Standards Organization (ISO). It is important to note that there are no competing standards for high performance LAN's so that FDDI acceptance is nearly universal. This technology report describes FDDI as a technology, looks at the applications of this technology, examine the current economics of using it, and describe activities and plans by the Information Resource Management (IRM) department to implement this technology at the Savannah River Site.

20616 (WSRC-MS–91-086) **Audit trails and PC control on Novell networks.** Cabot, A. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9105126–6: 14. DOE computer security group conference, Concord, CA (United States), 7-9 May 1991). Order Number DE92010695. Source: OSTI; NTIS; GPO Dep.

Although Novell Netware 286 provides excellent access control at both the server and the directory level, the record they make available through the accounting function leaves much to be desired. This paper presents two programs; the first is a BASIC program that converts the output of Novell's PAUDIT command into single line audit trails, providing an auditable record of server access. The second program, written in dBase III+, can be used to insure that all PC's accessing the LAN are recorded in an inventory data base. The subject network consists of six file servers connecting approximately 500 users at the main office of WSRC's Engineering and Projects Division. Hard copy and diskettes of the source code will be available.

20617 (WSRC-MS–91-230-Rev.1) **Computer applications for engineering/structural analysis: Revision 1.** Zaslawsky, M.; Samaddar, S.K. Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9110344–8-Rev.1: Westinghouse computer symposium, Monroeville, PA (United States), 21-22 Oct 1991). Order Number DE92013070. Source: OSTI; NTIS; GPO Dep.

Analysts and organizations have a tendency to lock themselves into specific codes with the obvious consequences of not addressing the real problem and thus reaching the wrong conclusion. This paper discusses the role of the analyst in selecting computer codes. The participation and support of a computation division in modifying the source program, configuration management, and pre- and post-processing of codes are among the subjects discussed. Specific examples illustrating the computer code selection process are described in the following problem areas: soil structure interaction, structural analysis of nuclear reactors, analysis of waste tanks where fluid structure interaction is important, analysis of equipment, structure-structure interaction, analysis of the operation of the superconductor supercollider which includes friction and transient temperature, and 3D analysis of the 10-meter telescope being built in Hawaii. Validation and verification of computer codes and their impact on the selection process are also discussed.

20618 (Y/DW–1094) **The MIG Program: Prioritization of maintenance work requests.** Davenport, C.M.; Hopper, L.E. Oak Ridge Y-12 Plant, TN (United States). Sep 1991. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92012107. Source: OSTI; NTIS; GPO Dep.

The Maintenance Importance Generator (MIG) program has been written to automatically prioritize all pending Oak Ridge Y-12 Plant maintenance jobs in conformity with DOE policy and regulatory requirements. The program captures and applies the knowledge and best practices of many experienced maintenance workers. Up to 40,000 work requests are prioritized or updated each week; maintenance foremen receive prioritized work-pending lists. MIG program results were uniformly good; it was implemented in the Metal Prep Division in August 1989 and has been in use for several months in other major production divisions. The program satisfied an Admiral Watkins' Tiger Team Top-10 Problem for Y-12 in 1990: "How to systematically prioritize work." The MIG program uses a weighted-factors method similar to that utilized by commercial, licensed methodologies for decision making. Each box on a Maintenance Work Request (MWR) form represents an importance factor. These factors were ranked relative to each other and were given appropriate weight increments by a consensus of maintenance and customer organization experts. Coordination was by the MIG program developers and included input from DOE and plant policy. The specific entry made by a customer in an MWR form box is read to determine the fraction of the box weight that will be applied to an accumulating priority number. Captured knowledge is used in this step. The straight sum of the weight increments of the individual factors is the final priority number. The weight increments and the captured knowledge represent the judgement of a decision committee that can be reused in a fully automatic process.

9903 Information Handling

Refer also to citation(s) 17839, 17859, 18033, 18037, 18058, 18114, 18271, 18324, 18363, 18595, 18616, 18629, 18769, 19361, 20526, 20577, 20585, 20613

20619 (ANL/CP–69894) **A methodology for benchmarking distributed database management systems.** Orji, C.U. Argonne National Lab., IL (United States). [1990]. 24p. Sponsored by Veterans Administration, Washington, DC (United States); Department of Veterans Affairs, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-900875–1: 16. international conference on very large databases; 7. IEEE international conference on data engineering, Brisbane (Australia); Kobe (Japan), 13-16 Aug 1990; 8-12 apr 1991; CONF-9104321–2). Order Number DE90007801. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A methodology for benchmarking distributed database management systems is proposed. A distributed environment is characterized in terms of the communication costs incurred in data movement between sites, the number of nodes that participate in processing a query and the data distribution scheme used in the network. These are used as a basis for identifying eight query types that capture the query performance characteristics in the network. Finally, an experimental outline is sketched to illustrate the steps in validating the methodology. 4 tabs.

20620 (CONF-920466–4) **Expert system for liquid low-level waste management.** Ferrada, J.J. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992. Order Number DE92011092. Source: OSTI; NTIS; INIS; GPO Dep.

An expert system prototype has been developed to support system analysis activities at the Oak Ridge National Laboratory (ORNL) for waste management tasks. This expert system will aid in prioritizing radioactive waste streams for treatment and disposal by evaluating the severity and treatability of the problem as well as the final waste form. The objectives of the expert system development included: (1) collecting information on process treatment technologies for liquid low-level waste (LLLW) that can be incorporated in the knowledge base of the expert system, and (2) producing a prototype that suggests processes and disposal technologies for the ORNL LLLW system. The concept under which the expert system has been designed is integration of knowledge. There are many sources of knowledge (data bases, text files, simulation programs, etc.) that an expert would regularly consult in order to solve a problem of liquid waste management. The expert would normally know how to extract the information from these different sources of knowledge. The general scope of this project would be to include as much pertinent information as possible within the boundaries of the expert system. As a result, the user, who may not be an expert in every aspect of liquid waste management, may be able to apply the content of the information to a specific waste problem. This paper gives the methodological steps to develop the expert system under this general framework.

20621 (DOE/ER–0533P) **FEDIX: The on-line database retrieval service of government information for colleges, universities, and other organizations: User's guide: Version 4.0/Release 2.0.** USDOE Office of Energy Research, Washington, DC (United States). Spr 1992. 79p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012384. Source: OSTI; NTIS; GPO Dep.

FEDIX is an on-line information service that links the higher education community and the federal government to facilitate research, education, and services. The system provides accurate and timely federal agency information to colleges, universities, and other research organizations. There are no registration fees and no access charges for using FEDIX. Agencies participating in the FEDIX system include: Department of Energy (DOE), Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), Office of Naval Research (ONR), Air Force Office of Scientific Research (AFOSR), National Science Foundation (NSF), National Security Agency (NSA), Department of Commerce (DOC), Department of Education (DOEd), Department of Housing and Urban Development (HUD), and Agency for International Development (AID). Additional government agencies are expected to join FEDIX in the near future. This guide is intended to help users access and utilize the FEDIX system. Because the system is frequently updated, however, some menus and tables used as examples in this text may not exactly match those displayed on the live system.

20622 (IIEC–92011741) **Technical Information Directory: An international directory of organizations that provide information on high efficiency energy technologies: First edition.** Grund, M.; Gronbeck, C. (comps.). International Inst. for Energy Conservation, Washington, DC (United States). Apr 1992. 108p. Sponsored by International Inst. for Energy Conservation, Washington, DC (United States). Source: OSTI; International Institute for Energy Conservation, 420 C Street, N.E., Washington, DC 20002.

Improved technologies and policy planning have made it possible for many industrialized countries to meet the demand for energy services with fewer energy resources. Many developing countries would like to employ such policies but have difficulty finding information about them. Energy policy planners at all levels invest significant resources researching technological and policy options for improving energy efficiency. The International Institute for Energy Conservation's (IIEC) Technical Information Directory addresses the problem of locating technical information. The directory profiles organizations that provide information on energy saving technologies and highlights useful materials and services they offer. The directory has two principle goals: to help individuals and institutions that do not have intimate knowledge of energy-saving technologies locate those that do, and to encourage the development of an international information sharing system to facilitate the sharing of information energy-saving technologies. The first edition primarily focuses on organizations that provide generic or non-product-specific information on energy-saving technologies. Many of the organizations profiled in these pages pursue additional activities that are beyond the scope of the directory. The Technical Information Directory evaluates only their ability to provide information on energy-saving technologies. All the information presented in the draft was drawn from materials produced by the organizations profiled or conversations with their staffs.

20623 (INIS-mf–13154) **Directory of IAEA databases.** International Atomic Energy Agency, Vienna (Austria). Nov 1991 118p. Order Number DE92628395. Source: OSTI; NTIS (US Sales Only); INIS.

The first edition of the Directory of IAEA Databases is intended to describe the computerized information sources available to IAEA staff members. It contains a listing of all databases produced at the IAEA, together with information on their availability.

20624 (INIS-SU–309/A, pp. 185-190) **Information-retrieval system for in-pile test methods and role of methodic information in planning investigations in the field of reactor materials testing.** Ivanov, V.B. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Lebedeva, E.E.; Markina, N.V.; Tsykanov, V.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 227p. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 4.* Order Number DE92001357. Source: OSTI; NTIS (US Sales Only); INIS.

Particular role of methodic information in research planning and automatomization considered. It is shown that availability of methodic information makes it possible to justify the necessity for experimental equipment developing, to compare the possibilities created by different investigation methods and to carry out optimal choice of the experiment fulfilment place. Necessity for developing the information-retrieval system on in-pile test methods and the required set of data based is discussed. The information on the expert system realized on PC AT is presented. Advantages and usefulness of systematization and information acquisition on methodic developments are shown, practical recommendations on their use are given.

20625 (LA-UR–92-653) **Information systems for engineering sustainable development.** Leonard, R.S. Los Alamos National Lab., NM (United States). 27 Feb 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9203126–1: Workshop on engineering partnerships for sustainable development in conjunction with prep con IV of the United Nations conference on environment and development, New York, NY (United States), 1-3 Mar 1992). Order Number DE92011271. Source: OSTI; NTIS; GPO Dep.

The ability of a country to follow sustainable development paths is determined to a large extent by the capacity or capabilities of its people and its institutions. Specifically, capacity-building in the UNCED terminology encompasses the country's human, scientific, technological, organizational, institutional, and resource capabilities. A fundamental goal of capacity-building is to enhance the ability to pose, evaluate and address crucial questions related to policy choices and methods of implementation among development options. As a result the United Nations Conference on Environment and Development (UNCED) Agenda 21 planning process has identified the need for better methods by which information can be transferred between industrialized nations and developing nations. The reasons for better methods of information transfer include facilitating decisions related to sustainable development and building the capacity of developing nations to better plan their future in both an economical and environmentally sound manner. This paper is a discussion on mechanisms for providing information and technologies available for presenting the information to a variety of cultures and levels of technical literacy. Consideration is given to access to information technology as well as to the cost to the user. One concept discussed includes an "Engineering Partnership" which brings together the talents and resources of private consulting engineers, corporations, non-profit professional organizations, government agencies and funding institution which work in partnership with each other and associates in developing countries. Concepts which are related to information technologies include a hypertext based, user configurable cultural translator and information navigator and the use of multi-media technologies to educate engineers about the concepts of sustainability, and the adaptation of the concept of metabolism to creating industrial systems.

20626 (NUREG–0910-Rev.2) **NRC comprehensive records disposition schedule: Revision 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Information Support Services. Mar 1992. 335p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Title 44 United States Code, "Public Printing and Documents," regulations cited in the General Services Administration's (GSA) "Federal Information Resources Management Regulations" (FIRMR), Part 201-9, "Creation, Maintenance, and Use of Records," and regulation issued by the National Archives and Records Administration (NARA) in 36 CFR Chapter XII, Subchapter B, "Records Management," require each agency to prepare and issue a comprehensive records disposition schedule that contains the NARA approved records disposition schedules for records unique to the agency and contains the NARA's General Records Schedules for records common to several or all agencies. The approved records disposition schedules specify the appropriate duration of retention and the final disposition for records created or maintained by the NRC. NUREG-0910, Rev. 2, contains "NRC's Comprehensive Records Disposition Schedule," and the original authorized approved citation numbers issued by NARA. Rev. 2 totally reorganizes the records schedules from a functional arrangement to an arrangement by the host office. A subject index and a conversion table have also been developed for the NRC schedules to allow staff to identify the new schedule numbers easily and to improve their ability to locate applicable schedules.

20627 (ORNL/TM–11938, pp. 21-32) **A strategy for the computation of conditional answers.** Demolombe, R. (ONERA/CERT, Toulouse (France)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

The author considers non-Horn Deductive Data Bases (DDB) represented in a First Order language without function symbols. In this context the DDB is an incomplete description of the world. A first approach to reduce the incompleteness is to add to the DDB some kind of default rules, in order to automatically assume missing information. The second approach , which is adopted in this paper, is to provide to the user the conditions which guarantee the validity of the answer. These conditional answers are generated by standard reasoning, and not by default reasoning. Then the problem is the following: if T represents the DDB and q the query, and if there is no direct answer to q, one wants to derive the more general conditions c such that: $T \vdash q \leftarrow c$. He resents a strategy, GASP, designed for this purpose. It is defined by meta rules, and these meta rules can be used for a least fixpoint operator definition. He shows that the GASP strategy is always more efficient than another usual strategy called GALP. Since in the case of recursive definitions the answers may be infinite GASP has been adapted into GRASP in order to only compute ground conditional answers. He shows that the least fixpoint operator associated to GRASP computes the answer in a finite number of steps, even if the DDB contains recursive definitions.

20628 (ORNL/TM–11938, pp. 179-190) **Bottom-up evaluation in indefinite deductive databases.** Sunderraman, R. (Wichita State Univ. (Kansas)). Oak Ridge National Lab., TN (United States). Sep 1991. (CESAR–91/32;CONF-9110260–: 6. international symposium on methodologies for intelligent systems, Charlotte, NC (United States), 16-19 Oct 1991). In *Proceedings of the sixth international symposium on methodologies for intelligent systems (Poster Session).* 215p. Order Number DE92002382. Source: OSTI; NTIS.

A bottom-up approach to evaluate non-Horn rules in indefinite databases is presented. Tabular structures, called C-tables, are used to represent disjunctive facts. Algebraic operations on C-tables are used to evaluate non-Horn rules. The bottom-up approach computes the fixpoint semantics of disjunctive deductive databases.

20629 (UCRL-CR–110424) **Electronic Commerce user manual.** Lawrence Livermore National Lab., CA (United States). 10 Apr 1992. 293p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE92013067. Source: OSTI; NTIS; GPO Dep.

This User Manual supports the Electronic Commerce Standard System. The Electronic Commerce Standard System is being developed for the Department of Defense of the Technology Information Systems Program at the Lawrence Livermore National Laboratory, operated by the University of California for the Department of Energy. The Electronic Commerce Standard System, or EC as it is known, provides the capability for organizations to conduct business electronically instead of through paper transactions. Electronic Commerce and Computer Aided Acquisition and Logistics Support, are two major projects under the DoD's Corporate Information Management program, whose objective is to make DoD business transactions faster and less costly by using computer networks instead of paper forms and postage. EC runs on computers that use the UNIX operating system and provides a standard set of applications and tools that are bound together by a common command and menu system. These applications and tools may vary according to the requirements of the customer or location and may be customized to meet the specific needs of an organization. Local applications can be integrated into the menu system under the Special Databases & Applications option on the EC main menu. These local applications will be documented in the appendices of this manual. This integration capability provides users with a common environment of standard and customized applications.

9904 Law

Refer also to citation(s) 18347

20630 (INFO–0213) **Atomic energy control board. History backgrounder.** Atomic Energy Control Board, Ottawa, ON (Canada). Oct 1986. 21p. (In English, French). Order Number DE92628393. Source: OSTI; NTIS (US Sales Only); INIS.

The Atomic Energy Control Board (AECB) is a regulatory agency set up by the Government of Canada under the Atomic Energy Control Act of 1946 to assist the Government in its efforts to make provision for the control and supervision of the development, application and use of atomic energy and to enable Canada to participate effectively in measures of international control of atomic energy. It is also responsible for the administration of the Nuclear Liability Act, including the designation of nuclear installations and the prescription of basic insurance to be carried by the operators of such nuclear installations. An overview is presented of the AECB's evolution in chronological form, its major current activities, and some of the challenges expected in the next decade.

20631 (INIS-mf–13190) **The regulatory process for the decommissioning of nuclear facilities.** Bezpecnost Jadernych Zarizeni. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1991 18p. Translation of an IAEA publication (Safety series No. 105). International Atomic Energy Agency, Vienna 1990. (In Czech). Order Number DE92628386. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this publication is to provide general guidance to Member States for regulating the decommissioning of nuclear facilities within the established nuclear regulatory framework. The Guide should also be useful to those responsible for, or interested in, the decommissioning of nuclear facilities. The Guide describes in general terms the process to be used in regulating decommissioning and the considerations to be applied in the development of decommissioning regulations and guides. It also delineates the responsibilities of the regulatory body and the licensee in decommissioning. The provisions of this Guide are intended to apply to all facilities within the nuclear fuel cycle and larger industrial installations using long-lived radionuclides. For smaller installations, however, less extensive planning and less complex regulatory control systems should be acceptable. The Guide deals primarily with decommissioning after planned shutdown. Most provisions, however, are also applicable to decommissioning after abnormal event, once cleanup operations have been terminated. The decommissioning planning in this case must take account of the abnormal event. 28 refs., 1 fig.

20632 (UMG-DGEN–92-1) **Investigation and exploitation of the radiation in peaceful uses and its juridical protection mechanism.** Solorzano R, S.A. (Facultad de Ciencias Juridicas y Sociales, Universidad Mariano Galvez de Guatemala, Guatemala City (Guatemala)). Universidad Mariano Galvez de Guatemala, Guatemala City (Guatemala). Facultad de Ciencias Juridicas y Sociales. Oct 1991 95p. (In Spanish). Order Number DE92628384. Source: OSTI; NTIS (US Sales Only); INIS.

In is included in a brief way the radioisotopes and ionizing radiations application in Guatemala; the risk an the radioactive damage from the juridical point of view; the nuclear energy's juridical nature, without any doubt, has its place in the law's world causing several effects which we have to determine the civil responsabilities; we expose the Guatemala's civil order the objective responsability of the nuclear law and its foundation. We had to mention the different international organisms that have relationship between each other in this area, for example: International Atomic Energy Agency (IAEA): Its objetives and functions; Its services and attendance; juridical activities, etc. and as a national institution the general Directorate for the Nuclear Energy that belong to the energy and Mines Ministry, it is the charge of the sutdy, promotion, control, supervision, thechnical vigilance and investigate the use of the nuclear energy In the juridical mechanisms of the radiation applications, we find in Guatemala the "protection an environment improvement law" decree 68-86 of the Republic Congress; "the control, use and application of radioisotopes and ionizing radiation law (nuclear law) law decree 11-86 which is transcribed because it is related with the nuclear energy subject. The rules also emphasize because of the technical aspects requirement concurrence that develop the law's precepts. As a viable juridical mechanism to guarantee the nuclear damage indemnity it is considered in others contracts determined the necessary constitution of the civil responsability insurance of the nuclear damages to guarantee the right indemnity of it. (Author).

GUATEMALA/atomic energy laws; GUATEMALA/radiation protection; ADMINISTRATIVE PROCEDURES; DEVELOPING COUNTRIES; ENVIRONMENTAL POLICY; GUATEMALA; LEGAL ASPECTS; LIABILITIES; ORGANIZING

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in ETDE/PUB–3, *International Energy: Research Organizations 1986–1990*. Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, indicated by International Organization for Standardization (ISO) country code; and (3) the language of the document if non-English (R;CA;In French). Author affiliations are not listed in this index.

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AC21-86MC21023	**Foster Wheeler Development Corp., Livingston, NJ (United States)**	
	17:17813	DOE/MC/21023–92/C0015
AC21-86MC23075	**Sandia National Labs., Albuquerque, NM (United States)**	
	17:17771	SAND–91-2695C
	Advanced Fuel Research, Inc., East Hartford, CT (United States)	
	17:17732	DOE/MC/23075–3079
	17:17733	DOE/MC/23075–3081
AC21-86MC23167	**Westinghouse Electric Corp., Orlando, FL (United States)**	
	17:18272	DOE/MC/23167–3056
	Westinghouse Electric Corp., Orlando, FL (United States). Power Generation Business Unit	
	17:18273	DOE/MC/23167–3065
AC21-87MC11089	**Institute of Gas Technology, Chicago, IL (United States)**	
	17:17890	DOE/MC/11089–92/C0007
AC21-87MC24266	**Institute of Gas Technology, Chicago, IL (United States)**	
	17:17734	DOE/MC/24266–3069-Vol.2
AC21-87MC24268	**Western Research Inst., Laramie, WY (United States)**	
	17:17735	DOE/MC/24268–3075
AC21-88MC25003	**General Electric Co., Schenectady, NY (United States). Corporate Research and Development Center**	
	17:17736	DOE/MC/25003–3045
AC21-88MC25006	**Research Triangle Inst., Research Triangle Park, NC (United States)**	
	17:17737	DOE/MC/25006–3057
AC22-85PC80016	**SRI International, Menlo Park, CA (United States)**	
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AC22-87PC79743	**Energy and Environmental Research Corp., Irvine, CA (United States)**	
	17:17815	DOE/PC/79743–T3
AC22-87PC79816	**Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Chemical Engineering**	
	17:17738	DOE/PC/79816–T3
AC22-87PC79818	**UOP, Inc., Des Plaines, IL (United States)**	
	17:17739	DOE/PC/79818–T5
	17:17740	DOE/PC/79818–T7
AC22-87PC79892	**Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mining and Minerals Engineering**	
	17:17709	DOE/PC/79892–T18
	17:17710	DOE/PC/79892–T19
	17:17741	DOE/PC/79892–T16
AC22-87PC79903	**Stanford Univ., CA (United States)**	
	17:17787	DOE/PC/79903–T12
	Stanford Univ., CA (United States). High Temperature Gasdynamics Lab.	
	17:17786	DOE/PC/79903–T11
AC22-87PC90005	**Air Products and Chemicals, Inc., Allentown, PA (United States)**	
	17:17755	DOE/PC/90005–T57
AC22-87PC90274	**TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div.**	
	17:18675	DOE/PC/90274–T12
	17:18676	DOE/PC/90274–T13
AC22-88PC88814	**Advanced Fuel Research, Inc., East Hartford, CT (United States)**	
	17:17744	DOE/PC/88814–T7

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AC22-88PC88851	**Southern Research Inst., Birmingham, AL (United States)**	
	17:17789	DOE/PC/88851–T1
AC22-88PC88852	**United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations**	
	17:17790	DOE/PC/88852–T5
AC22-88PC88891	**Institute of Gas Technology, Chicago, IL (United States)**	
	17:17745	DOE/PC/88891–T8
AC22-89BC14260	**Kawasaki Thermal Systems, Inc., Bakersfield, CA (United States)**	
	17:17834	DOE/BC/14260–10-App.-Vol.1
	17:17835	DOE/BC/14260–10-App.-Vol.2
AC22-89PC88654	**Combustion Engineering, Inc., Windsor, CT (United States)**	
	17:17816	DOE/PC/88654–T4
	17:17817	DOE/PC/88654–T5
AC22-89PC89807	**Research-Cottrell, Inc., Somerville, NJ (United States). Environmental Services and Technologies Div.**	
	17:17791	DOE/PC/89807–T7
AC22-89PC89870	**Viking Systems International, Pittsburgh, PA (United States)**	
	17:17753	DOE/PC/89870–T1-Suppl.
AC22-89PC89883	**Consolidation Coal Co., Library, PA (United States). Research and Development Dept.**	
	17:17754	DOE/PC/89883–37
AC22-90PC90361	**North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center**	
	17:17793	DOE/PC/90361–T5
AC22-90PC90363	**Energy and Environmental Research Corp., Irvine, CA (United States)**	
	17:17794	DOE/PC/90363–T3
AC22-91PC90056	**Kentucky Univ., Lexington, KY (United States). Research Foundation**	
	17:17757	DOE/PC/90056–T2
	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	17:17756	DOE/PC/90056–T1
AC22-91PC90185	**Worcester Polytechnic Inst., MA (United States)**	
	17:17807	DOE/PC/90185–T4
AC22-91PC90365	**Southern Research Inst., Birmingham, AL (United States)**	
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AC22-91PC91337	**NOXSO Corp., Library, PA (United States)**	
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AC34-90DP62349	**EG and G Rocky Flats, Inc., Golden, CO (United States)**	
	17:18893	RFP–4447-Pt.1-Rev.
	17:18894	RFP–4447-Pt.2-Rev.
	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
	17:19354	RFP–4529
	17:18895	RFP–4565
AC35-89ER40486	**USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff**	
	17:19201	CONF-9105202–
	Superconducting Super Collider Lab., Dallas, TX (United States)	
	17:19188	SSCL–530
	17:19189	SSCL–570
	17:19190	SSCL-Preprint–72
	17:19233	SSCL–561
	17:19234	SSCL-Preprint–74
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AC79-85BP23821	**Washington State Energy Office, Olympia, WA (United States)**	
	17:18691	DOE/BP–1787
AC79-90BP10392	**Baker, Reiter and Associates, Seattle, WA (United States)**	
	17:18692	DOE/BP/10392–1
AI05-90ER30174	**Mitre Corp., McLean, VA (United States). Jason Program Office**	
	17:19419	JSR–91-330A
	17:20294	JSR–90-310
AI05-90OR21929	**Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)**	
	17:19518	K/GDP/SAR–15
AI08-78ET44802	**Geological Survey, Denver, CO (United States)**	
	17:18063	USGS/OFR–90-355
	17:18064	USGS-OFR–91-367
	Geological Survey, Menlo Park, CA (United States)	
	17:19954	USGS-OFR–91-105
AI79-86BP64840	**USDOE Bonneville Power Administration, Portland, OR (United States)**	
	17:18223	DOE/BP/64840–3
AM03-76SF00010	**Stanford Linear Accelerator Center, Menlo Park, CA (United States)**	
	17:19333	SLAC-PUB–5745
AS03-89ER40527	**Stanford Linear Accelerator Center, Menlo Park, CA (United States)**	
	17:19226	SLAC-PUB–5760
	17:19231	SLAC-PUB–5782
AS03-90ER40583	**California Univ., Los Angeles, CA (United States). Dept. of Physics**	
	17:19203	DOE/ER/40583–T2
AS05-76EV02412	**Emory Univ., Atlanta, GA (United States)**	
	17:19937	ORO–2412-110
FC01-91EI22786	**Maine State Planning Office, Augusta, ME (United States)**	
	17:17853	DOE/EI/22786–T1
FC03-85DP40200	**Rochester Univ., NY (United States). Lab. for Laser Energetics**	
	17:20263	DOE/DP/40200–196
	17:20438	DOE/DP/40200–188
FC03-89SF17960	**Oregon Univ., Eugene, OR (United States). Center for Housing Innovation**	
	17:18694	DOE/SF/17960–T12
FC07-79NV10031	**Hawaii Natural Energy Inst., Manoa, HI (United States)**	
	17:18805	DOE/NV/10031–T1
FC07-89ID12847	**EG and G Idaho, Inc., Idaho Falls, ID (United States)**	
	17:18831	EGG-M–91135
FC21-86MC11076	**Western Research Inst., Laramie, WY (United States)**	
	17:17730	DOE/MC/11076–3061
	17:17731	DOE/MC/11076–3062
	17:17784	DOE/MC/11076–3073
	17:17886	DOE/MC/11076–3072
FC21-89MC26019	**Southern Co. Services, Inc., Birmingham, AL (United States). Research and Environmental Affairs Dept.**	
	17:18274	DOE/MC/26019–3071
FC21-89MC26268	**Utah Univ., Salt Lake City, UT (United States)**	
	17:17885	DOE/MC/26268–3039
	Utah Univ., Salt Lake City, UT (United States). Dept. of Fuels Engineering	
	17:17887	DOE/MC/26268–92/C0012

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FC22-83FE60149	**National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States)**	
	17:17830	NIPER–575
	17:17831	NIPER–581
	17:17838	NIPER–573
	17:17839	NIPER–583
	17:17840	NIPER–593
FC22-87PC79796	**Energy and Environmental Research Corp., Irvine, CA (United States)**	
	17:17785	DOE/PC/79796–T18
FC22-90PC89659	**Babcock and Wilcox Co., Cassville, WI (United States)**	
	17:17818	DOE/PC/89659–T8
FC22-90PC89663	**ABB/Combustion Engineering, Inc., Windsor, CT (United States)**	
	17:17707	CONF-911041–7
FC22-91PC90542	**AIRPOL, Inc., Teterboro, NJ (United States)**	
	17:17796	DOE/PC/90542–T4
FC22-91PC90545	**Babcock and Wilcox Co., Barberton, OH (United States). Energy Services Div.**	
	17:17820	DOE/PC/90545–T4
FC22-91PC90548	**LIFAC North America, Inc., Oakland, CA (United States)**	
	17:17797	DOE/PC/90548–T4
FG01-85ER60319	**National Research Council, Washington, DC (United States). Commission on Physical Sciences, Mathematics, and Resources**	
	17:19945	DOE/ER/60319–T1
FG01-89CE26597	**Washington State Energy Office, Olympia, WA (United States)**	
	17:18167	WAOENG–90-07
	17:18197	WAOENG–91-05
	17:18715	WAOENG–89-63
	17:18716	WAOENG–89-67
	17:18718	WAOENG–91-04
	17:18719	WAOENG–91-06
FG01-90IE10859	**East-West Center, Honolulu, HI (United States)**	
	17:18621	DOE/IE/10859–T3
FG01-91CE15517	**Servo-Dynamics, Inc., Santa Barbara, CA (United States)**	
	17:17836	DOE/CE/15517–T2
FG02-84ER40171	**Harvard Univ., Cambridge, MA (United States). High Energy Physics Lab.**	
	17:19275	DOE/ER/40171–4
FG02-84ER45097	**Argonne National Lab., IL (United States)**	
	17:18923	ANL/CP–75723
FG02-84ER45125	**Northwestern Univ., Evanston, IL (United States)**	
	17:19025	DOE/ER/45125–9
FG02-85ER13318	**Massachusetts Univ., Amherst, MA (United States). Goessmann Lab.**	
	17:18741	DOE/ER/13318–T1
FG02-85ER13403	**Lehigh Univ., Bethlehem, PA (United States)**	
	17:18957	DOE/ER/13403–4
FG02-85ER45182	**Denver Univ., CO (United States). Dept. of Physics**	
	17:18827	DOE/ER/45182–6
FG02-85ER60314	**State Univ. of New York, Stony Brook, NY (United States)**	
	17:19401	DOE/ER/60314–T3
	State Univ. of New York, Stony Brook, NY (United States). Inst. for Atmospheric Sciences	
	17:19400	DOE/ER/60314–10
FG02-86ER13503	**Princeton Univ., NJ (United States). Dept. of Mechanical and Aerospace Engineering**	
	17:19060	CONF-920707–21
FG02-86ER13506	**Syracuse Univ., NY (United States). Dept. of Chemistry**	
	17:18233	DOE/ER/13506–37
FG02-86ER13539	**Wisconsin Univ., Madison, WI (United States). Lab. of Genetics**	
	17:19572	DOE/ER/13539–3
FG02-86ER13566	**Rensselaer Polytechnic Inst., Troy, NY (United States). Mechanics of Materials Lab.**	
	17:18826	DOE/ER/13566–5
FG02-86ER13590	**State Univ. of New York, Stony Brook, NY (United States). Dept. of Chemistry**	
	17:20284	DOE/ER/13590–10
FG02-86ER13634	**Smithsonian Astrophysical Observatory, Cambridge, MA (United States)**	
	17:20285	DOE/ER/13634–2
FG02-86ER53214	**Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Physics and Astronomy**	
	17:20363	DOE/ER/53214–2
	17:20364	DOE/ER/53214–T1
FG02-86ER53218	**Wisconsin Univ., Madison, WI (United States). Center for Plasma Theory and Computation**	
	17:20425	UW-CPTC–92-1
FG02-87ER13700	**Iowa Univ., Iowa City, IA (United States)**	
	17:20286	DOE/ER/13700–T2
FG02-87ER13707	**Wisconsin Univ., Madison, WI (United States). Dept. of Biochemistry**	
	17:19576	DOE/ER/13707–2
FG02-87ER13747	**State Univ. of New York, Plattsburgh, NY (United States). Center for Earth and Environmental Sciences**	
	17:19469	DOE/ER/13747–11
FG02-87ER13775	**State Univ. of New York, Buffalo, NY (United States). Research Foundation**	
	17:19022	DOE/ER/13775–3
	17:19023	DOE/ER/13775–T1
FG02-87ER40316	**Oak Ridge National Lab., TN (United States)**	
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FG02-87ER40328	**Minnesota Univ., Minneapolis, MN (United States). School of Physics and Astronomy**	
	17:20165	DOE/ER/40328–T1
FG02-87ER45290	**Pennsylvania Univ., Philadelphia, PA (United States)**	
	17:18821	CONF-911003–25
	Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Materials Science and Engineering	
	17:18822	CONF-911202–71
FG02-87ER45297	**Arizona Univ., Tucson, AZ (United States)**	
	17:18928	DOE/ER/45297–28
FG02-87ER45309	**Northwestern Univ., Evanston, IL (United States)**	
	17:18929	DOE/ER/45309–4
FG02-87ER53250	**Purdue Univ., Lafayette, IN (United States). School of Nuclear Engineering**	
	17:20365	DOE/ER/53250–3
	17:20366	DOE/ER/53250–5
FG02-88ER13965	**Rochester Univ., NY (United States)**	
	17:20272	DOE/ER/13965–4
FG02-88ER40406	**Oak Ridge National Lab., TN (United States)**	
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FG02-88ER40452	**Brown Univ., Providence, RI (United States). Dept. of Physics**	
	17:19276	DOE/ER/40452–6
FG02-88ER45372	**Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy**	
	17:18930	DOE/ER/45372–4
FG02-88ER60621	**Rochester Univ., NY (United States). School of Medicine and Dentistry**	
	17:19873	DOE/ER/60621–5
FG02-89ER12894	**Northwestern Univ., Evanston, IL (United States)**	
	17:18343	DOE/ER/12894–3
FG02-89ER14004	**Ohio State Univ., Columbus, OH (United States). Dept. of Horticulture**	
	17:19569	DOE/ER/14004–3
FG02-89ER14083	**Utah Univ. Research Inst., Salt Lake City, UT (United States). Earth Science Lab.**	
	17:18257	DOE/ER/14083–1
FG02-89ER45394	**Princeton Univ., NJ (United States). Dept. of Geological and Geophysical Sciences**	
	17:18931	DOE/ER/45394–3
FG02-89ER45403	**Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering**	
	17:18829	DOE/ER/45403–3
FG02-90CH10461	**Illinois Univ., Chicago, IL (United States). Energy Resources Center**	
	17:18740	DOE/CH/10461–1
FG02-90ER20003	**Illinois Univ., Urbana, IL (United States). Dept. of Plant Biology**	
	17:19574	DOE/ER/20003–1
FG02-90ER25086	**Colorado Univ., Denver, CO (United States)**	
	17:20250	DOE/ER/25086–2
FG02-90ER45419	**Lehigh Univ., Bethlehem, PA (United States)**	
	17:18960	DOE/ER/45419–2
FG02-90ER45433	**New Hampshire Univ., Durham, NH (United States). Dept. of Mechanical Engineerng**	
	17:18830	DOE/ER/45433–1
FG02-90ER60931	**USDOE Office of Energy Research, Washington, DC (United States). Scientific Computing Staff**	
	17:19933	CONF-9105202–
FG02-90ER61013	**Syracuse Univ., NY (United States)**	
	17:19946	DOE/ER/61013–2
FG02-90ER61066	**Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science**	
	17:19947	DOE/ER/61066–T1
FG02-90ER61072	**State Univ. of New York, Albany, NY (United States). Atmospheric Sciences Research Center**	
	17:19343	DOE/ER/61072–4
	17:19402	DOE/ER/61072–2
FG02-90ER75564	**Industrial Technology Inst., Ann Arbor, MI (United States)**	
	17:18637	DOE/ER/75564–9
FG02-90MI10158	**Bronx Community Coll., New York, NY (United States). Business and Professional Development Inst.**	
	17:20504	DOE/MI/10158–1
FG02-91ER14189	**Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Chemistry**	
	17:19062	DOE/ER/14189–1
FG02-91ER14192	**Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering**	
	17:19063	DOE/ER/14192–1
FG02-91ER14194	**Wisconsin Univ., Madison, WI (United States). Dept. of Geology and Geophysics**	
	17:19944	DOE/ER/14194–1
FG02-91ER25099	**Illinois Univ., Urbana, IL (United States)**	
	17:20264	DOE/ER/25099–1
FG02-91ER40606	**Fermi National Accelerator Lab., Batavia, IL (United States)**	
	17:20024	FNAL/C–91/349-A
	17:20025	FNAL/C–92/20-A
FG02-91ER40628	**Washington Univ., St. Louis, MO (United States). Dept. of Physics**	
	17:19993	DOE/ER/40628–1
FG02-91ER40652	**Creighton Univ., Omaha, NE (United States)**	
	17:20022	DOE/ER/40652–1
FG02-91ER54131	**College of Staten Island, NY (United States)**	
	17:20367	DOE/ER/54131–1
FG02-91ER61136	**Rhode Island Hospital, Providence, RI (United States)**	
	17:19575	DOE/ER/61136–1
FG02-91ER61202	**Columbia Univ., Palisades, NY (United States). Lamont-Doherty Geological Observatory**	
	17:19948	DOE/ER/61202–1
FG02-91ER61220	**Massachusetts Inst. of Tech., Cambridge, MA (United States)**	
	17:19404	DOE/ER/61220–1
FG02-91ER61229	**Eye Research Inst. of Retina Foundation, Boston, MA (United States)**	
	17:19344	DOE/ER/61229–1
FG03-84ER60219	**University of Southern California, Los Angeles, CA (United States)**	
	17:19580	DOE/ER/60219–T2
FG03-86ER13469	**California Univ., Irvine, CA (United States). Dept. of Chemistry**	
	17:19020	DOE/ER/13469–T2
FG03-87ER13657	**Aerospace Corp., El Segundo, CA (United States). Engineering and Technology Group**	
	17:19021	DOE/ER/13657–T1
FG03-87ER13705	**California Univ., Davis, CA (United States). Dept. of Biochemistry and Biophysics**	
	17:19573	DOE/ER/13705–T2
FG03-87ER13738	**California Univ., Santa Barbara, CA (United States)**	
	17:20291	DOE/ER/13738–T2
FG03-87ER13812	**Aerospace Corp., Los Angeles, CA (United States). Space and Environment Technology Center**	
	17:19061	DOE/ER/13812–T1
FG03-87ER45332	**California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics**	
	17:18828	DOE/ER/45332–T1
FG03-88ER13842	**California Univ., Santa Barbara, CA (United States). Dept. of Chemistry**	
	17:19024	DOE/ER/13842–T2
FG03-88ER13911	**Science Applications International Corp., San Diego, CA (United States)**	
	17:19109	DOE/ER/13911–T2
FG03-88ER45375	**IBM Research Div., San Jose, CA (United States). Almaden Research Center**	
	17:18959	DOE/ER/45375–T1
FG03-89ER60673	**California Univ., Davis, CA (United States)**	
	17:19571	DOE/ER/60673–T3
FG03-89ER14049	**California Univ., Los Angeles, CA (United States)**	
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FG03-89ER14066	**California Univ., Los Angeles, CA (United States)**	
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FG03-90ER60981	**Scripps Institution of Oceanography, La Jolla, CA (United States)**	
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FG03-90ER60982	**Scripps Institution of Oceanography, La Jolla, CA (United States)**	
	17:19555	DOE/ER/60982-2
FG03-91ER14176	**California Univ., San Diego, La Jolla, CA (United States). Inst. of Pure and Applied Physical Sciences**	
	17:19971	DOE/ER/14176-T1
FG04-87AL43771	**Lawrence Livermore National Lab., CA (United States)**	
	17:19075	UCRL-JC-109756
FG05-80ET53088	**Texas Univ., Austin, TX (United States). Inst. for Fusion Studies**	
	17:20368	DOE/ET/53088-530
	17:20369	DOE/ET/53088-541
FG05-84ER13262	**Texas A and M Univ., College Station, TX (United States). Cyclotron Inst.**	
	17:20278	DOE/ER/13262-8
FG05-84ER13263	**North Carolina Univ., Charlotte, NC (United States). Dept. of Chemistry**	
	17:19019	DOE/ER/13263-8
FG05-84ER40159	**Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Physics and Astronomy**	
	17:20174	DOE/ER/40159-182
FG05-85ER45208	**Florida State Univ., Tallahassee, FL (United States)**	
	17:20329	DOE/ER/45208-7
FG05-85OR21555	**Tennessee Univ., Knoxville, TN (United States)**	
	17:17911	DOE/OR/21555-T7
	Tennessee Dept. of Health and Environment, Nashville, TN (United States)	
	17:17909	DOE/OR/21555-T5
	17:17912	DOE/OR/21555-T8
	Tennessee Dept. of Transportation, Nashville, TN (United States)	
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AECB-C–					
110	17:18639	OSTI; NTIS (US Sales Only); INIS		DE92627087	
117	17:19263	OSTI; NTIS (US Sales Only); INIS		DE92626968	
36	17:18118	OSTI; NTIS (US Sales Only); INIS		DE92627123	
83	17:18347	OSTI; NTIS (US Sales Only); INIS		DE92627122	
AECL–					
10009	17:17919	OSTI; NTIS (US Sales Only); INIS		DE92627044	
10030	17:18733	OSTI; NTIS (US Sales Only); INIS		DE92627038	
10048	17:19827	OSTI; NTIS (US Sales Only); INIS		DE92626158	
10183/F	17:17920	OSTI; NTIS (US Sales Only); INIS		DE92627045	
10196	17:20494	OSTI; NTIS (US Sales Only); INIS		DE92627151	
10293	17:19870	OSTI; NTIS (US Sales Only); INIS		DE92626201	
10298	17:18361	OSTI; NTIS (US Sales Only); INIS		DE92626849	
10300	17:17921	OSTI; NTIS (US Sales Only); INIS		DE92627039	
10325	17:18315	OSTI; NTIS (US Sales Only); INIS		DE92626943	
10332	17:20495	OSTI; NTIS (US Sales Only); INIS		DE92627152	
10337	17:19153	OSTI; NTIS (US Sales Only); INIS		DE92626802	
10339	17:18316	OSTI; NTIS (US Sales Only); INIS		DE92628216	
10364	17:19169	OSTI; NTIS (US Sales Only); INIS		DE92626812	
10370	17:19451	OSTI; NTIS (US Sales Only); INIS		DE92625809	
10380	17:17922	OSTI; NTIS (US Sales Only); INIS		DE92627046	
10384	17:19452	OSTI; NTIS (US Sales Only); INIS		DE92625793	
10398	17:19828	OSTI; NTIS (US Sales Only); INIS		DE92626159	
10420	17:20496	OSTI; NTIS (US Sales Only); INIS		DE92627153	
10430	17:17923	OSTI; NTIS (US Sales Only); INIS		DE92627047	
10431	17:19154	OSTI; NTIS (US Sales Only); INIS		DE92626803	
10459	17:18362	OSTI; NTIS (US Sales Only); INIS		DE92626850	
10461	17:19116	OSTI; NTIS (US Sales Only); INIS		DE92626843	
10464	17:18317	OSTI; NTIS (US Sales Only); INIS		DE92628217	
10476	17:17904	OSTI; NTIS (US Sales Only); INIS		DE92626801	
10507	17:20528	OSTI; NTIS (US Sales Only); INIS		DE92627145	
10508	17:18318	OSTI; NTIS (US Sales Only); INIS		DE92628218	
10524	17:19047	OSTI; NTIS (US Sales Only); INIS		DE92627040	
8852	17:18817	OSTI; NTIS (US Sales Only); INIS		DE92625623	
8905	17:19450	OSTI; NTIS (US Sales Only); INIS		DE92625794	
8958	17:18370	OSTI; NTIS (US Sales Only); INIS		DE92626865	
9331	17:18313	OSTI; NTIS (US Sales Only); INIS		DE92626944	
9333	17:18314	OSTI; NTIS (US Sales Only); INIS		DE92628219	
9433	17:19264	OSTI; NTIS (US Sales Only); INIS		DE92626994	
9825-1	17:19868	OSTI; NTIS (US Sales Only); INIS		DE92626202	
9952	17:18818	OSTI; NTIS (US Sales Only); INIS		DE92625597	
9982	17:18355	OSTI; NTIS (US Sales Only); INIS		DE92626959	
AEEW-M–					
2464	17:18548	*See* NUREG/IA–0027			

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AEEW-R–					
2435	17:18555	*See* NUREG/IA–0058			
AERE-R–					
13826	17:19871	OSTI; NTIS (US Sales Only); INIS		DE92627979	
8176(rev.1)	17:19043	OSTI; NTIS (US Sales Only); INIS		DE92627736	
AFME–					
89-04-0019-1	17:18592	OSTI; NTIS (US Sales Only)		DE92792640	
89-04-0019-2	17:18593	OSTI; NTIS (US Sales Only)		DE92792648	
90-11-1	17:18734	OSTI; NTIS (US Sales Only)		DE92792641	
90-11-2	17:18735	OSTI; NTIS (US Sales Only)		DE92792639	
90-11-3	17:18765	OSTI; NTIS (US Sales Only)		DE92792642	
90-11-4	17:19121	OSTI; NTIS (US Sales Only)		DE92792645	
AIAA–					
92-1465	17:19099	*See* SAND–92-0662C			
ANL–					
91/3	17:19453	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012282	PC-607
91/4	17:17809	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011867	MF-310
91/42	17:18987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013641	PC-500
91/45	17:18677	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012398	MF-317
92-9	17:17924	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011753	MF-814
92/4	17:18546	*See* NUREG/CR–5841			
92/5	17:18766	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013740	PC-350
ANL-HEP-CP–					
90-33	17:19265	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE90011107	MF-414
90-88	17:19266	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91004768	MF-414
92-13	17:19267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011197	MF-414
92-17	17:20138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011833	MF-414
ANL/APS/IN/VIB–					
89/1	17:19159	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012175	MF-414
89/2	17:19191	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012379	MF-406
89/3	17:19192	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012174	MF-414
90/1	17:19160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012173	MF-414; MF-403
90/3	17:19193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013068	MF-414
91/1	17:19194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012178	MF-406
91/2	17:19195	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012172	MF-406; MF-414
91/3	17:19196	OSTI; NTIS; INIS; GPO Dep.	E 1.90:	DE92012177	MF-414
ANL/CP–					
69894	17:20619	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90007801	
72713	17:18371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011841	MF-539
72713	17:18372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018616	MF-539
73465	17:18289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012654	
73759	17:18920	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010498	MF-404
74094	17:18597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010900	MF-800
74200	17:17925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010516	MF-902
74206	17:17926	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010887	MF-902
74367	17:20548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011843	MF-505
74391	17:18373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011838	MF-530; MF-505
74392	17:18374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011842	MF-539
74459	17:18375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011836	MF-530; MF-505
74461	17:18376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011837	MF-530; MF-505
74502	17:18951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010514	MF-506
74638	17:18819	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011834	MF-332
74864	17:18723	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013057	MF-335
74903	17:20549	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013058	MF-405
75202	17:20169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010274	MF-413
75215	17:19079	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012653	MF-506
75224	17:17810	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010888	MF-103; MF-369
75281	17:19454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010902	
75282	17:18952	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010903	MF-310
75316	17:20550	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010905	
75335	17:20497	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011839	MF-507
75357	17:18322	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010901	MF-506
75375	17:18921	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010904	MF-373
75450	17:18922	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009712	MF-404
75478	17:18323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013040	MF-506

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75635	17:17778	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010279	MF-105
75636	17:19553	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010278	MF-400
75640	17:18408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013051	MF-506
75684	17:18953	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011846	MF-804; MF-810
75716	17:18409	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011845	MF-506
75723	17:18923	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010908	MF-404
75733	17:18767	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010906	MF-249
75747	17:18377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011840	MF-541T
75769	17:18410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011844	MF-506
75814	17:19455	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013062	MF-902
75861	17:19242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013060	MF-411
75862	17:19197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013059	MF-411
75957	17:19350	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013041	MF-107
ANL/EAIS/TM–					
68	17:17918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012258	MF-800
ANL/ESD–					
14	17:18724	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012259	MF-330
ANL/ESD/TM–					
22-Vol.1	17:17802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012102	MF-330; MF-900
23	17:19389	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012160	MF-402
24	17:18725	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013252	
25	17:19829	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012103	
26	17:19456	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013298	
27	17:20338	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012683	
29	17:18726	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013296	
ANL/HEP/TR–					
92/06	17:19268	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011210	MF-414
ANL/RP–					
75855	17:19457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012684	MF-511
ANL/TM–					
500	17:20498	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012399	MF-400
ANS–					
2595-R28.	17:18095	*See* DOE-HMIP-RR–91.060			
2595-R28.	17:19556	*See* DOE-HMIP-RR–91.059			
ANSTO-M–					
120	17:20551	OSTI; NTIS (US Sales Only); INIS		DE92627146	
ANU-P–					
1082	17:20208	OSTI; NTIS (US Sales Only); INIS		DE92627398	
1089	17:20170	OSTI; NTIS (US Sales Only); INIS		DE92627328	
1096	17:20171	OSTI; NTIS (US Sales Only); INIS		DE92627347	
AUC-IBT-R–					
9011	17:19126	OSTI; NTIS (US Sales Only)		DE92506384	
9202	17:18263	OSTI; NTIS (US Sales Only)		DE92506391	
AX–					
720936	17:17927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013127	MF-702
BARC–					
1991/E/015	17:19269	OSTI; NTIS (US Sales Only); INIS		DE92627003	
1991/P/001	17:20351	OSTI; NTIS (US Sales Only); INIS		DE92627438	
1991/P/002	17:17892	OSTI; NTIS (US Sales Only); INIS		DE92625522	
1991/P/003	17:20271	OSTI; NTIS (US Sales Only); INIS		DE92627427	
BFR-D–					
20-91	17:18686	OSTI; NTIS (US Sales Only)		DE92506621	
BFR-R–					
6-92	17:18768	OSTI; NTIS (US Sales Only)		DE92506622	
8-92	17:18687	OSTI; NTIS (US Sales Only)		DE92506623	
BMI–					
2173-Vol.1-No.2	17:18367	*See* NUREG/CR–4599-Vol.1-No.2			
BNL–					
45624	17:19265	*See* ANL-HEP-CP–90-33			
46332	17:19198	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011003	MF-414
46678	17:19170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012543	MF-414
46683	17:19171	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013031	MF-414
46684	17:19172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013032	MF-414
46685	17:19173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013033	MF-414
46686	17:19174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013034	MF-414
46687	17:19175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012209	MF-414
46958	17:19059	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007180	MF-401
46979	17:20139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011475	MF-414

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46985	17:19014	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007183	MF-401
47087	17:19578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011552	MF-408
47167	17:17779	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012210	MF-101
47216	17:18411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013309	MF-500
47220	17:19342	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011553	MF-406
47317	17:19199	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012212	MF-414
47318	17:20298	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012211	MF-410
47331	17:18319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012303	MF-406
47339	17:18105	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012520	MF-607
47356	17:19253	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013011	MF-400
47378	17:19176	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013035	MF-414
47420	17:19270	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012208	MF-401
BNL-NUREG–					
52311	17:18341	*See* NUREG/CR–5815			
BONN-HE–					
92-04	17:19956	OSTI; NTIS (US Sales Only); INIS		DE92517007	
BONN-IR–					
91-67	17:20064	OSTI; NTIS (US Sales Only); INIS		DE92511425	
91-69	17:20065	OSTI; NTIS (US Sales Only); INIS		DE92517032	
91-72	17:19271	OSTI; NTIS (US Sales Only); INIS		DE92511567	
91-73	17:20066	OSTI; NTIS (US Sales Only); INIS		DE92511568	
91-75	17:20067	OSTI; NTIS (US Sales Only); INIS		DE92517029	
92-02	17:19272	OSTI; NTIS (US Sales Only); INIS		DE92517030	
92-03	17:19273	OSTI; NTIS (US Sales Only); INIS		DE92511566	
92-04	17:20552	OSTI; NTIS (US Sales Only); INIS		DE92517031	
BfS-ET–					
11/91	17:17931	OSTI; NTIS (US Sales Only); INIS		DE92511575	
3/90	17:17928	OSTI; NTIS (US Sales Only); INIS		DE92511570	
3/90-REV-1	17:17929	OSTI; NTIS (US Sales Only); INIS		DE92511569	
5/90-REV-1	17:17930	OSTI; NTIS (US Sales Only); INIS		DE92506634	
BfS-ISH–					
155/91	17:19458	OSTI; NTIS (US Sales Only); INIS		DE92517151	
156/91	17:17932	OSTI; NTIS (US Sales Only); INIS		DE92511501	
CANDEV–					
86-110.	17:18313	*See* AECL–9331			
CCSN–					
17.	17:18642	*See* INFO–0359			
CDM–					
27	17:19015	OSTI; NTIS (US Sales Only); INIS		DE92625329	
CEA-CONF–					
10503	17:17933	OSTI; NTIS (US Sales Only); INIS		DE92517855	
10529	17:17934	OSTI; NTIS (US Sales Only); INIS		DE92517854	
CEA-DAS–					
747	17:17935	OSTI; NTIS (US Sales Only); INIS		DE92517863	
CERN-TH–					
6350/91	17:20072	*See* DESY–91-140			
CESAR–					
92/11A	17:20556	*See* CONF-9206152–1-Extd.Abst.			
CFFTP-G–					
91112	17:20440	*See* DOE/ER/54091–1			
CMI-R–					
91/A30015	17:18598	OSTI; NTIS (US Sales Only)		DE92506532	
91/A30019	17:17843	OSTI; NTIS (US Sales Only)		DE92506531	
91/A30020	17:17844	OSTI; NTIS (US Sales Only)		DE92506530	
COG–					
90-148.	17:18361	*See* AECL–10298			
91-261.	17:20528	*See* AECL–10507			
91-283.	17:19047	*See* AECL–10524			
91-292.	17:17904	*See* AECL–10476			
91-297.	17:19452	*See* AECL–10384			
91-305.	17:17923	*See* AECL–10430			
CONF-8605373–		(Symposium on the total risk and benefit impact of energy alternatives; Waterloo (Canada); 20-23 May 1986)			
	17:18640	*See* INFO–0207			
CONF-8704405–		(12. Science teachers seminar; Chalk River (Canada); 2-4 Apr 1987)			
	17:19264	*See* AECL–9433			

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CONF-870812–		(9. biennial international conference on structural mechanics in reactor technology (SMIRT-9); Lausanne (Switzerland); 17-21 Aug 1987)			
	17:18314	*See* AECL–9333			
CONF-870961–		(4. symposium on containment of underground nuclear explosions; Colorado Springs, CO (United States); 21-24 Sep 1987)			
12	17:19379	*See* UCRL-CR–109639			
CONF-8804342–		(Working conference on experience and problems of optimization of dosimetric measurements and organizing of the regional system of radioecological monitoring; Vilnius (USSR); 20-22 Apr 1988)			
	17:19901	*See* INIS-SU–313			
CONF-8810289–		(11. All-Union conference on charged particle accelerators; Dubna (USSR); 25-27 Oct 1988)			
	17:19156	*See* JINR-D–9-89-52(v.2)			
CONF-890854–		(11. annual DOE low level waste management conference; Pittsburgh, PA (United States); 22-24 Aug 1989)			
16	17:18082	*See* WSRC-RP–89-16			
CONF-890901–		(14. world energy conference; Montreal (Canada); 17-22 Sep 1989)			
	17:18355	*See* AECL–9982			
CONF-8909470–		(HAZTECH international '89 conference; Cincinnati, OH (United States); 12-14 Sep 1989)			
	17:18733	*See* AECL–10030			
CONF-8909472–		(National seminar on degradation of nuclear power plant materials by the working environment; Cesky Krumlov (Czechoslovakia); 28-29 Sep 1989)			
	17:18835	*See* INIS-mf–13159			
CONF-8910482–		(Human genome I: international conference on the status and future of research on the human genome; San Diego, CA (United States); 2-4 Oct 1989)			
1	17:19568	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011906	MF-408
CONF-8910571–		(ALCOA technical symposium on opportunities for computer science to advance materials science; Pittsburgh, PA (United States); 15-17 Oct 1989)			
1	17:20596	*See* PNL-SA–17467			
CONF-8911130–		(11. US/Japan workshop on field-reversed configurations and compact toroids; Los Alamos, NM (United States); 7-9 Nov 1989)			
15	17:18131	*See* UCRL–102612			
CONF-8912137–		(Solid state physics symposium; Madras (India); 19-22 Dec 1989)			
	17:20293	*See* INIS-mf–13178			
CONF-8912170–		(GAMNI-SMAI conference on numerical methods for the Maxwell equations; Paris (France); Dec 1989)			
1	17:19970	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012187	MF-700
CONF-9001171–		(Experts' discussion: Potential and assessment of alternative energy conversion processes; Berlin (Germany); 12 Jan 1990)			
	17:18736	OSTI; NTIS (US Sales Only)		DE92515841	
CONF-9003318–		(Seminar on bioconversion of plant raw materials - biotechnology advancement; Mustio (Finland); 14-16 Mar 1990)			
	17:18761	*See* VTT-SYMP–122			
CONF-9003319–		(Bruce 'B' maintenance conference; Tiverton (Canada); 15 Mar 1990)			
	17:18361	*See* AECL–10298			
CONF-900348–		(2. international industrialization symposium on the super collider (IISSC); Miami, FL (United States); 14-16 Mar 1990)			
6	17:19265	*See* ANL-HEP-CP–90-33			

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CONF-900391–		(1990 American Institute of Chemical Engineers (AIChE) spring health and safety symposium; Orlando, FL (United States); 18-22 Mar 1990)			
7	17:17780	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011911	MF-105
CONF-900397–		(1. Los Alamos symposium on ultra-wideband radar; Los Alamos, NM (United States); 5-8 Mar 1990)			
3-Rev.1	17:19146	*See* UCRL-JC–103782-Rev.1			
CONF-900406–		(1. international topical meeting on high-level radioactive waste management; Las Vegas, NV (United States); 8-12 Apr 1990)			
90	17:18083	*See* WSRC-RP–89-842			
CONF-9004146–		(16. DOE compatibility, aging and service life conference; Livermore, CA (United States); 24-26 Apr 1990)			
10	17:18132	*See* WSRC-MS–90-82			
CONF-9005165–		(6. meeting of Interagency Mechanical Operations Group (IMOG); Amarillo, TX (United States); 1-3 May 1990)			
3	17:19108	*See* WSRC-MS–90-139			
CONF-9005247–		(International conference on radiation material science; Alushta (USSR); 22-25 May 1990)			
	17:18862	*See* INIS-SU–309/A			
CONF-900603–		(EPAC '90: 2nd European particle accelerator conference ACROPOLIS; Nice (France); 11-16 Jun 1990)			
65	17:20484	*See* UCRL-JC–104099			
CONF-900621–		(30. annual conference of the Canadian Nuclear Association and the 11th annual conference of the Canadian Nuclear Society; Toronto (Canada); 3-7 Jun 1990)			
	17:18316	*See* AECL–10339			
CONF-900684–		(5. international colloquium on free boundary problems: theory and applications; Montreal (Canada); 13-22 Jun 1990)			
1-Rev.2	17:19980	*See* UCRL-JC–103243-Rev.2			
CONF-9007106–		(31. Institute of Nuclear Materials Management (INMM) conference; Los Angeles, CA (United States); 15-18 Jul 1990)			
91	17:19012	*See* WSRC-MS–90-85			
CONF-9007244–		(3. ICFA School on Instrumentation in Elementary Particle Physics; Rio de Janeiro (Brazil); 16-28 Jul 1990)			
	17:19322	*See* LAL-RT–90-06			
CONF-900809–		(21. Department of Energy/Nuclear Regulatory Commission (DOE/NRC) nuclear air cleaning conference; San Diego, CA (United States); 13-16 Aug 1990)			
4	17:19083	*See* DP-MS–89-1292			
CONF-9008168–		(9. International conference on experimental mechanics; Copenhagen (Denmark); 20-24 Aug 1990)			
1	17:18914	*See* WSRC-MS–90-93			
CONF-900875–		(16. international conference on very large databases; 7. IEEE international conference on data engineering; Brisbane (Australia); Kobe (Japan); 13-16 Aug 1990; 8-12 apr 1991)			
1	17:20619	*See* ANL/CP–69894			
CONF-9009208–		(3. European community conference on radioactive waste management and disposal; Luxembourg (Luxembourg); 17-21 Sep 1990)			
	17:17933	*See* CEA-CONF–10503			
	17:17934	*See* CEA-CONF–10529			
	17:17935	*See* CEA-DAS–747			
CONF-9009266–		(2. international colloquium on X-ray lasers; York (United Kingdom); 17-21 Sep 1990)			
15	17:20276	*See* UCRL-JC–104651			
17	17:19129	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012252	MF-712

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-9009489–		(23. convegno nazionale AIM; Ancona (Italy); 25-27 Sep 1990)			
1	17:18834	*See* ETDE-IT–92-25			
CONF-9009490–		(Prospettive delle misure elettriche ed elettroniche; Padua (Italy); 20-22 Sep 1990)			
	17:19968	*See* ETDE-IT–92-24			
CONF-901008–		(Fall meeting of the Minerals, Metals and Materials Society (TMS); Detroit, MI (United States); 7-11 Oct 1990)			
14	17:18915	*See* WSRC-MS–90-105			
CONF-9010176–		(18. annual Illinois energy conference energy aspects of solid waste management; Chicago, IL (United States); 29-30 Oct 1990)			
	17:18740	*See* DOE/CH/10461–1			
CONF-9010212–		(Symposium on detector research and development for the Superconducting Super Collider; Fort Worth, TX (United States); 15-18 Oct 1990)			
23	17:19266	*See* ANL-HEP-CP–90-88			
CONF-901034–		(1990 international joint power generation conference; Boston, MA (United States); 21-25 Oct 1990)			
2	17:18404	*See* WSRC-MS–90-195			
CONF-901035–		(37. national American Vacuum Society symposium; Toronto (Canada); 8-12 Oct 1990)			
22	17:20298	*See* BNL–47318			
CONF-9010484–		(91. AEI annual meeting; Turin (Italy); Oct 1990)			
1	17:18579	*See* ETDE-IT–92-26			
CONF-9010488–		(16. MPA-seminar; Pinawa (Canada); 4-5 Oct 1990)			
	17:18315	*See* AECL–10325			
CONF-9010489–		(Workshop on scattering experiments under extreme conditions; Tsukuba (Japan); 12-13 Oct 1990)			
	17:20321	*See* KEK-PROC–91-9			
CONF-901057–		(7. international symposium on capture gamma-ray spectroscopy and related topics; Pacific Grove, CA (United States); 14-19 Oct 1990)			
31	17:20205	*See* UCRL-JC–104964			
CONF-901101–		(American Nuclear Society (ANS) winter meeting; Washington, DC (United States); 11-16 Nov 1990)			
87	17:19548	*See* WSRC-MS–90-199X			
CONF-901105–		(Fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 24 Nov - 1 dec 1990)			
134	17:18900	*See* UCRL-JC–104592			
135	17:18982	*See* UCRL-JC–104516			
CONF-9011149–		(1990 nuclear explosives code developers' conference; Monterey, CA (United States); 6-9 Nov 1990)			
20	17:19380	*See* UCRL-JC–105269			
CONF-9011285–		(Rumore e vibrazioni: valutazione, prevenzione e bonifica; Bologna (Italy); 20-21 Nov 1990)			
1	17:19939	*See* ETDE-IT–92-23			
CONF-9011286–		(Seminar on underwater technology; Tampere (Finland); 1 Nov 1990)			
	17:18732	*See* VTT-SYMP–120			
CONF-901202–		(Ultrasonics symposium; Honolulu, HI (United States); 5-7 Dec 1990)			
2	17:19981	*See* UCRL-JC–104580			
CONF-9012123–		(DAE symposium on nuclear physics; Madras (India); 1-4 Dec 1990)			
	17:20166	*See* INIS-mf–13179			
CONF-901264–		(Workshop on radioactive, hazardous, and/or mixed wastes sludge management; Knoxville, TN (United States); 4-5 Dec 1990)			
	17:17936	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012667	MF-510

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-901291-		(Symposium on the manifestations of the electron-phonon interaction in copper oxides (CuO) and related superconductors; Oaxtepec (Mexico); 11-14 Dec 1990)			
3	17:18928	*See* DOE/ER/45297–28			
CONF-9101138-		(United Nations regional disarmament workshop for Asia and the Pacific; Bandung (Indonesia); 28 Jan 1991)			
	17:18814	*See* INIS-mf–13168			
CONF-910247-		(International conference on research trends in inertial confinement fusion; La Jolla, CA (United States); 4-9 Feb 1991)			
4	17:20370	*See* ETDE-IT–92-20			
CONF-910249-		(International topical conference on research trends in coherent radiation generation and particle accelerators; La Jolla, CA (United States); 11-13 Feb 1991)			
2	17:20565	*See* ETDE-IT–92-38			
CONF-910252-		(1991 American Nuclear Society (ANS) meeting; Albuquerque, NM (United States); 24-28 Feb 1991)			
3	17:18567	*See* WSRC-MS–91-033			
CONF-9103235-		(American Institute of Aeronautics and Astronautics (AIAA) space programs and technologies conference; Huntsville, AL (United States); 24-27 Mar 1991)			
1	17:19093	*See* SAND–91-1704C			
CONF-9103236-		(North Atlantic Treaty Organization (NATO), Advance Study Institute (ASI) meeting; Aussois (France); 25 Mar - 5 apr 1991)			
1	17:19114	*See* UCRL-JC–106761			
CONF-910374-		(American Society for Testing and Materials (ASTM) symposium on mechanics and mechanisms of material damping; Baltimore, MD (United States); 13-15 Mar 1991)			
2	17:18879	*See* IS-M–683			
CONF-910396-		(1. European biennial workshop on nuclear physics; Megeve (France); 25-29 Mar 1991)			
	17:19328	*See* PCCF-RI–91-04			
CONF-910399-		(American Society for Nondestructive Testing spring conference; Oakland, CA (United States); 18-22 Mar 1991)			
5	17:19336	*See* UCRL-JC–105234			
6	17:18901	*See* UCRL-JC–105329			
7	17:18983	*See* UCRL-JC–105233			
8	17:19335	*See* UCRL-JC–105226			
CONF-910406-		(Spring meeting of the Materials Research Society (MRS); Anaheim, CA (United States); 29 Apr - 3 may 1991)			
40	17:18902	*See* UCRL-JC–106149			
CONF-9104256-		(Symposium on nuclear waste management; Cincinnati, OH (United States); 28 Apr - 2 may 1991)			
16	17:18074	*See* WSRC-MS–91-009			
CONF-910431-		(Ironmaking and steel making conference; Washington, DC (United States); 14-17 Apr 1991)			
2	17:18831	*See* EGG-M–91135			
CONF-9104321-		(16. international conference on very large databases; 7. IEEE international conference on data engineering; Brisbane (Australia); Kobe (Japan); 13-16 Aug 1990; 8-12 apr 1991)			
2	17:20619	*See* ANL/CP–69894			
CONF-9104355-		(1991 American Society of Civil Engineers (ASCE) structures congress; Indianapolis, IN (United States); 29 Apr - 1 may 1991)			
1	17:19951	*See* UCRL-JC–104837			
CONF-9104359-		(Bioenergy and the greenhouse effect; Stockholm (Sweden); 15-16 Apr 1991)			
	17:18671	*See* NUTEK-B–91-1			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-9104370–		(Workshop of the FOBOS Collaboration; Dresden (Germany); Apr 1991)			
	17:20249	*See* ZfK–751			
CONF-910460–		(International Sherwood fusion theory conference; Seattle, WA (United States); 22-24 Apr 1991)			
2-Vugraphs	17:20426	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013227	MF-420
CONF-9105126–		(14. DOE computer security group conference; Concord, CA (United States); 7-9 May 1991)			
6	17:20616	*See* WSRC-MS–91-086			
CONF-9105238–		(Conference on computational quantum physics; Nashville, TN (United States); 22-25 May 1991)			
7	17:20068	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011069	MF-414
CONF-9105239–		(Conference on gauge theories: past and future; Ann Arbor, MI (United States); 16-18 May 1991)			
2	17:20194	*See* LBL–31382			
CONF-9105335–		(14. Urban data management symposium; Odense (Denmark); 29-31 May 1991)			
Vol.1	17:18595	*See* NEI-DK–811			
Vol.2	17:18596	*See* NEI-DK–812			
CONF-9105338–		(5. Meeting on advanced detectors; La Biodola (Italy); 26-31 May 1991)			
	17:19285	*See* INFN-LNF–91-061(R)			
	17:19286	*See* INFN-LNF–91-062(R)			
CONF-910559–		(10. annual international incineration conference: environmental concerns and controls; Knoxville, TN (United States); 13-17 May 1991)			
10	17:18075	*See* WSRC-MS–91-050			
CONF-910572–		(5. international symposium on nondestructive characterization of materials; Karuizawa (Japan); 27-30 May 1991)			
	17:19116	*See* AECL–10461			
CONF-910602–		(1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference; San Diego, CA (United States); 23-27 Jun 1991)			
66	17:18566	*See* WHC-SA–1011			
CONF-9106194–		(International workshop on pions in nuclei; Penyscola (Spain); 2-9 Jun 1991)			
8	17:20248	*See* LA-UR–92-751			
CONF-9106209–		(International Atomic Energy Agency (IAEA) technical committee meeting on alpha particles in fusion; Aspenas (Sweden); 10-14 Jun 1991)			
5	17:20371	*See* ETDE-IT–92-30			
6	17:20372	*See* ETDE-IT–92-31			
CONF-9106260–		(Symposium on high brightness beams for advanced accelerator applications; College Park, MD (United States); 6-7 Jun 1991)			
	17:19206	*See* GSI–91-63(prepr.)			
CONF-9106351–		(7. convegno nazionale Gruppo Italiano Frattura (IGF); Florence (Italy); 13-14 Jun 1991)			
1	17:18833	*See* ETDE-IT–92-21			
CONF-9106352–		(Giornata di studio 'Distribuzione 2000'; Pisa (Italy); Jun 1991)			
1	17:18275	*See* ETDE-IT–92-34			
CONF-9106355–		(Colloquium on environmental impact assessment in the field of research; Bonn (Germany); 5 Jun 1991)			
	17:18624	*See* Juel–2553			
CONF-910711–		(20. international conference on phenomena in ionized gases; Barga (Italy); 8-12 Jul 1991)			
9	17:20358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013226	MF-427
CONF-9107134–		(7. annual coal preparation, utilization, and environmental control contractors conference; Pittsburgh, PA (United States); 15-18 Jul 1991)			
4	17:17781	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011744	MF-105

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-910714–		(International topical meeting on safety of thermal reactors; Portland, OR (United States); 21-25 Jul 1991)			
	17:18317	*See* AECL–10464			
CONF-9107180–		(47. annual calorimetry conference; DeKalb, IL (United States); 1 Jul - 1 aug 1991)			
2	17:19036	*See* LBL–31194			
CONF-9107218–		(International Astronomical Union (IAU) conference on nonlinear phenomena in stellar variability; Buenos Aires (Argentina); 23 Jul - 1 aug 1991)			
1	17:19973	*See* LA-UR–92-845			
2	17:19983	*See* UCRL-JC–109222			
CONF-910730–		(4. international conference on synchrotron radiation instrumentation; Chester (United Kingdom); 15-19 Jul 1991)			
30	17:19168	*See* LBL–31243			
CONF-910739–		(28. national heat transfer conference; Minneapolis, MN (United States); 26-31 Jul 1991)			
6-Pt.1	17:18430	*See* LA-UR–91-209			
CONF-910746–		(17. international conference on the physics of electronic and atomic collisions; Brisbane (Australia); 10-16 Jul 1991)			
	17:20279	*See* ESM–33			
5	17:20277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011779	MF-413
CONF-910776–		(11. international symposium on nuclear quadrupole resonance spectroscopy (ISNQRS-11); London (United Kingdom); 15-19 Jul 1991)			
	17:20326	*See* RAL–91-096			
CONF-9108118–		(13. international free-electron laser (FEL) conference; Santa Fe, NM (United States); 25-30 Aug 1991)			
47	17:19198	*See* BNL–46332			
48	17:19134	*See* LA-UR–92-754			
CONF-9108140–		(Phenomenology and applications of high temperature superconductivity; Los Alamos, NM (United States); 22-24 Aug 1991)			
	17:20349	*See* LA-UR–92-922			
CONF-9108146–		(16. international conference on infrared and millimeter waves; Lausanne (Switzerland); 26-30 Aug 1991)			
2	17:20429	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011813	MF-421
CONF-9108186–		(Relativistic aspects of nuclear physics; Rio de Janeiro (Brazil); 2-30 Aug 1991)			
2	17:20053	*See* LBL–31483			
3	17:20024	*See* FNAL/C–91/349-A			
CONF-9108194–		(3. workshop on computer security incident handling; Herndon, VA (United States); 6-8 Aug 1991)			
4	17:20601	*See* UCRL-JC–108515			
5	17:20602	*See* UCRL-JC–108548			
CONF-910836–		(19. SLAC summer institute on particle physics; Stanford, CA (United States); 5-16 Aug 1991)			
3	17:19994	*See* FNAL/C–92/79			
CONF-910852–		(Summer national meeting of the American Institute of Chemical Engineers (AIChE); Pittsburgh, PA (United States); 20-22 Aug 1991)			
20	17:17719	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011912	MF-108
CONF-910857–		(International School of Plasma Physics Piero Caldirola' diagnostics for contemporary fusion experiments; Varenna (Italy); 27 Aug - 6 sep 1991)			
9	17:20421	*See* UCRL-CR–107774			
CONF-910864–		(4. international conference on hadron spectroscopy; College Park, MD (United States); 12-16 Aug 1991)			
	17:20140	*See* DESY–91-145			
13	17:20069	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012267	MF-414

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CONF-910902–		(1991 international conference on coal science; Newcastle upon Tyne (United Kingdom); 16-20 Sep 1991)			
13	17:17811	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011749	MF-113
14	17:17720	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011750	MF-108
15	17:17721	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011745	MF-113
CONF-9109107–		(Workshop on biophysical modelling of radiation effects; Padua (Italy); 2-5 Sep 1991)			
5	17:19908	*See* LBL–31398			
CONF-910920–		(4. topical meeting on tritium technology in fission, fusion, and isotopic applications; Albuquerque, NM (United States); 29 Sep - 4 oct 1991)			
	17:19047	*See* AECL–10524			
CONF-9109221–		(21. international symposium on multiparticle dynamics; Wuhan (China); 23-27 Sep 1991)			
	17:20117	*See* MPI-PhE–91-09			
CONF-9109234–		(4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991)			
Absts.	17:19460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011935	MF-402
CONF-9109256–		(10. Pfefferkorn conference on signal and image processing in microscopy and microanalysis; Cambridge (United Kingdom); 16-19 Sep 1991)			
2	17:20299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011787	MF-410
CONF-9109297–		(8. international conference on fourier tranform spectroscopy; Lubeck-Travemunde (Germany); 1-6 Sep 1991)			
2	17:19009	*See* IS-M–686			
CONF-9109328–		(Physics with e^+e^- linear colliders; Hamburg (Germany); 2-4 Sep 1991)			
	17:20074	*See* DESY–91-155			
	17:20118	*See* PHE–91-09			
CONF-9109330–		(Hadron structure '91; Stara Lesna (Czechoslovakia); 16-20 Sep 1991)			
	17:20119	*See* PHE–91-014			
CONF-9109356–		(Polarized target workshop; Heidelberg (Germany); 23-28 Sep 1991)			
1	17:20169	*See* ANL/CP–75202			
CONF-9109357–		(6. international workshop on low temperature particle detectors; Oxford (United Kingdom); 5 Sep 1991)			
1	17:19276	*See* DOE/ER/40452–6			
CONF-9109360–		(13. annual internationial meeting of the Alternative Natural Philosophy Association (ANPA); Cambridge (United Kingdom); 12-15 Sep 1991)			
1	17:19955	*See* SLAC-PUB–5732			
CONF-9109364–		(1991 DYNA3D user's group conference; Bournemouth (United Kingdom); 27-28 Sep 1991)			
1	17:18906	*See* UCRL-JC–107883			
CONF-9109373–		(3. CSNI workshop on iodine chemistry in reactor safety; Tokai (Japan); 11-13 Sep 1991)			
	17:18288	*See* JAERI-M–92-012			
CONF-9109374–		(Workshop on physics and experiments with linear colliders; Saariselkae (Finland); Sep 1991)			
	17:20070	*See* DESY–91-109			
CONF-9109375–		(5. International trade fair machinery equipment, plant and raw materials for the entire ceramics and powder metallurgy industry (CERAMITEC-5) with international ceramitec symposium and annual meeting; Munich (Germany); 17 Sep 1991)			
	17:18932	*See* INIS-mf–14056			
CONF-910936–		(International conference on high temperature aluminides and intermetallics; San Diego, CA (United States); 17-19 Sep 1991)			
10	17:18907	*See* UCRL-JC–108606			

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CONF-910943–		(4. international conference on ion sources; Bensheim (Germany); 30 Sep - 4 oct 1991)			
5	17:20485	*See* UCRL-JC–106802			
CONF-910993–		(International conference on nuclear criticality (ICNC) safety; Oxford (United Kingdom); 9-13 Sep 1991)			
20	17:19092	*See* SAND–90-3111C			
CONF-911003–		(Fall meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals; Cincinnati, OH (United States); 20-24 Oct 1991)			
25	17:18821	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011646	MF-404
CONF-911004–		(3. conference on radiation protection and dosimetry; Orlando, FL (United States); 21-24 Oct 1991)			
	17:19919	*See* ORNL/TM–11882			
Absts.	17:19920	*See* ORNL/TM–11882-Absts.			
CONF-9110118–		(Accelerator instrumentation workshop; Newport News, VA (United States); 28-31 Oct 1991)			
6	17:19204	*See* FNAL/C–91/307			
CONF-9110127–		(Conference on global climate change: its mitigation through improved production and utilization of energy; Los Alamos, NM (United States); 21-24 Oct 1991)			
3	17:18602	*See* UCRL-JC–109004			
CONF-9110129–		(8. Korea-U.S. joint workshop on coal utilization technology; Seoul (Korea, Republic of); 28 Oct - 1 nov 1991)			
1	17:17708	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011913	MF-102
2	17:17782	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011742	MF-105
CONF-911014–		(International conference on dynamics and control in nuclear power stations; 8. power plant dynamics, control and testing symposium; London (United Kingdom); Knoxville, TN (United States); 22-24 Oct 1991; 27-29 may 1992)			
2	17:18372	*See* ANL/CP–72713			
CONF-9110220–		(North Atlantic Treaty Organization (NATO) advanced research workshop; Mount Hood, OR (United States); 6-11 Oct 1991)			
2	17:18767	*See* ANL/CP–75733			
CONF-9110256–		(Symposium of northeastern accelerator personnel; Albuquerque, NM (United States); 15-19 Oct 1991)			
5	17:19220	*See* LA-UR–92-905			
CONF-9110310–		(Gamma ray burst conference; Huntsville, AL (United States); 17-18 Oct 1991)			
4	17:19985	*See* UCRL-JC–110087			
CONF-9110312–		(NATO Advanced Studies Institute on the biological effects and physics of solar and galactic cosmic radiation conference; Faro (Portugal); 13-22 Oct 1991)			
2	17:19909	*See* LBL–31685			
CONF-9110318–		(SuperLEAR workshop; Zurich (Switzerland); 9-12 Oct 1991)			
1	17:20139	*See* BNL–46979			
CONF-9110332–		(International workshop on electroweak physics beyond the standard model; Valencia (Spain); 2-5 Oct 1991)			
2	17:20023	*See* FNAL/C–91/335-A			
CONF-9110340–		(DOE/DMS workshop on future synchrotron VUV X-ray beam lines; Gatlinburg, TN (United States); 21-23 Oct 1991)			
	17:20300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011883	MF-414
CONF-9110344–		(Westinghouse computer symposium; Monroeville, PA (United States); 21-22 Oct 1991)			
8-Rev.1	17:20617	*See* WSRC-MS–91-230-Rev.1			
CONF-9110357–		(European aerosol conference; Karlsruhe (Germany); 28-31 Oct 1991)			
1	17:19424	*See* LBL–31214			

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CONF-9110359–		(International school on electron microscopy in materials science; Brindisi (Italy); 7-11 Oct 1991)			
1	17:20301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010647	MF-410
CONF-9110360–		(Exotic nuclei; South Crimea (USSR); 1-5 Oct 1991)			
1	17:20193	*See* LA-UR–92-980			
CONF-9110364–		(10. annual joint meeting of the Canada-Korea business council; Montreal (Canada); 21 Oct 1991)			
	17:18318	*See* AECL–10508			
CONF-9110365–		(23. Brazilian congress on radiology; 21st meeting on radiology from Sao Paulo; 10th course of recycling; 6th congress of technician on radiology from Sao Paulo; 1st congress from South-east region of; Sao Paulo (Brazil); 11-15 Oct 1991)			
	17:19582	*See* INIS-BR–2922			
CONF-9110366–		(Austrian biomass day of the Oekoenergie; St. Andrae (Austria); 17 Oct 1991)			
	17:18188	*See* INIS-mf–13169			
	17:18189	*See* INIS-mf–13170			
	17:18190	*See* INIS-mf–13171			
	17:18192	*See* INIS-mf–13173			
	17:18194	*See* INIS-mf–13175			
	17:18195	*See* INIS-mf–13176			
	17:18208	*See* INIS-mf–13177			
CONF-9110367–		(Changing the face of science and mathematics education through teacher-focused partnerships: sharing our success; Berkeley, CA (United States); 2-4 Oct 1991)			
Summ.	17:20492	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011884	MF-400
CONF-9110369–		(3. Joint Department of Energy/National Science Foundation (DOE/NSF) workshop on flow of particulates and fluids; Worcester, MA (United States); 22-24 Oct 1991)			
	17:17806	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012692	MF-117
CONF-9110375–		(2. annual conference of The Japan Society of Waste Management Experts (JSWME); Tokyo (Japan); 28-30 Oct 1991)			
	17:18738	OSTI; NTIS (US Sales Only)		DE92514163	
CONF-9110379–		(4. workshop on WENDELSTEIN 7-X; Schloss Ringberg (Germany); 28-31 Oct 1991)			
	17:20448	*See* IPP–2/313			
CONF-911041–		(8. annual international Pittsburgh coal conference; Pittsburgh, PA (United States); 14-18 Oct 1991)			
6	17:17722	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011253	MF-108
7	17:17707	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010149	MF-105
CONF-911064–		(SPIE International Society for Optical Engineering meeting; Boulder, CO (United States); 23-25 Oct 1991)			
9	17:20336	*See* UCRL-JC–109627			
CONF-911102–		(4. international conference on stability and handling of liquid fuels; Orlando, FL (United States); 19-22 Nov 1991)			
Vol.1	17:17865	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013168	MF-125
Vol.2	17:17866	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013167	MF-125
CONF-911103–		(Conference on supercomputing '91; Albuquerque, NM (United States); 14-16 Nov 1991)			
8	17:20553	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011144	MF-405
CONF-911106–		(IEEE nuclear science symposium; Santa Fe, NM (United States); 5-9 Nov 1991)			
89	17:18947	*See* LBL–31456			
92	17:19819	*See* LBL–31457			
93	17:19325	*See* LBL–31596			
CONF-9111124–		(1991 RELAP5/TRAC-B international users seminar; Baton Rouge, LA (United States); 4-8 Nov 1991)			
5	17:18420	*See* EGG-M–91372			

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6-Pt.2	17:18569	*See* WSRC-MS–91-451			
CONF-9111141–		(Workshop on long-baseline neutrino oscillations; Batavia, IL (United States); 17-20 Nov 1991)			
5	17:19279	*See* FNAL/C–92/63			
6	17:20142	*See* FNAL/C–92/62			
7	17:20138	*See* ANL-HEP-CP–92-17			
Summ.	17:20141	*See* FNAL/C–92/26A			
CONF-9111165–		(Quark matter '91; Gatlinburg, TN (United States); 11-15 Nov 1991)			
12	17:20025	*See* FNAL/C–92/20-A			
CONF-9111181–		(8. biennial nuclear explosives design conference; Albuquerque, NM (United States); 18-22 Nov 1991)			
2	17:18345	*See* UCRL-JC–108960			
3	17:18565	*See* UCRL-JC–108959			
CONF-9111206–		(1991 electric arc furnace conference; Toronto (Canada); 13 Nov 1991)			
1	17:18743	*See* EGG-M–91551			
CONF-9111208–		(19. INFN eloisation project: maximizing luminosity of hadron colliders at 100 TeV; Erice (Italy); 13-19 Nov 1991)			
1	17:19184	*See* SLAC-PUB–5781			
CONF-9111209–		(Beryllium technology workshop; Clearwater Beach, FL (United States); 20 Nov 1991)			
	17:20443	*See* EGG-FSP–10017			
CONF-9111210–		(Many aspects of neutrino physics; Workshop on long-baseline neutrino oscillations; Batavia, IL (United States); Batavia, IL (United States); 14-17 Nov 1991; 17-20 nov 1991)			
Summ.	17:20141	*See* FNAL/C–92/26A			
CONF-9111213–		(10. core group meeting on the programme for promoting nuclear non-proliferation; Princeton, NJ (United States); 8-10 Nov 1991)			
1	17:18810	*See* UCRL-JC–109224			
CONF-9111217–		(L'Europa dei teleservizi tecnici: le esperienze dei gestori e le prospettive di sviluppo; Rome (Italy); 21-22 Nov 1991)			
1	17:18699	*See* ETDE-IT–92-22			
2	17:19351	*See* ETDE-IT–92-27			
3	17:19352	*See* ETDE-IT–92-28			
4	17:18578	*See* ETDE-IT–92-29			
CONF-9111218–		(I sistemi di qualificazione e certificazione: la normativa ISO 9000; Rome (Italy); 29 Nov 1991)			
1	17:19086	*See* ETDE-IT–92-36			
CONF-911123–		(15. international symposium on the scientific basis for nuclear waste management; Strasbourg (France); 5-8 Nov 1991)			
4	17:18062	*See* UCRL-JC–107901			
CONF-911139–		(Managing hazardous air pollutants: state of the art; Washington, DC (United States); 4-6 Nov 1991)			
2	17:17779	*See* BNL–47167			
CONF-911182–		(Eastern oil shale symposium, oil shale, tar sands, heavy oil; Lexington, KY (United States); 13-15 Nov 1991)			
4	17:17890	*See* DOE/MC/11089–92/C0007			
11	17:17887	*See* DOE/MC/26268–92/C0012			
CONF-911195–		(Army symposium on solid mechanics: synergism of mechanics, mathematics and materials; Plymouth, MA (United States); 4-7 Nov 1991)			
3	17:18908	*See* UCRL-JC–108728			
CONF-911202–		(Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991)			
39	17:20270	*See* UCRL-JC–109000			
67	17:19825	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010447	MF-408; MF-406
68	17:18920	*See* ANL/CP–73759			
69	17:20297	*See* UCRL-JC–109001			
70	17:18903	*See* UCRL-JC–107696			

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71	17:18822	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011645	MF-404
72	17:18924	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011686	MF-332
73	17:20296	*See* UCRL-JC–108753			
74	17:18823	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011671	MF-404
75	17:18904	*See* UCRL-JC–107793			
76	17:18911	*See* UCRL-JC–109268			
77	17:18897	*See* SAND–92-8411C			
CONF-9112107–		(Nobel jubliee symposium on low dimensional properties of solids; Gothenburg (Sweden); 4-7 Dec 1991)			
1	17:18922	*See* ANL/CP–75450			
CONF-9112110–		(3. annual symposium on environmental protection in energy industry; Tulsa, OK (United States); 12 Dec 1991)			
1	17:17861	*See* PNL-SA–20173			
CONF-9112111–		(KEK workshop on rare kaon decay physics; Tsukuba (Japan); 10-11 Dec 1991)			
1	17:20082	*See* FNAL/C–92/65			
CONF-9112112–		(Surface processing applications to transportation and utilities technologies; Washington, DC (United States); 10-12 Dec 1991)			
1	17:18680	*See* LA-UR–92-984			
CONF-9112113–		(Global climate change: linking energy, environment, economy, and equity; Washington, DC (United States); 5-6 Dec 1991)			
1	17:18607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011672	MF-902
CONF-911212–		(7. world conference on the chemistry of the atmosphere: its impact on global changes; Baltimore, MD (United States); 2-6 Dec 1991)			
1	17:19546	*See* UCRL-JC–107393			
CONF-911213–		(American Society of Mechanical Engineers (ASME) annual winter meeting; Atlanta, GA (United States); 1-6 Dec 1991)			
24	17:20600	*See* UCRL-JC–107865			
25	17:18905	*See* UCRL-JC–107866			
CONF-911226–		(SO_2 control symposium; Washington, DC (United States); 3-6 Dec 1991)			
2	17:17783	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011743	MF-105
CONF-911234–		(Conference on maintenance and repair welding in power plants; Orlando, FL (United States); 9-11 Dec 1991)			
1	17:18406	*See* WSRC-MS–91-406			
CONF-911267–		(DARPA/Rome laboratory symposium on photonics systems for antenna applications; Monterey, CA (United States); 10-12 Dec 1991)			
3	17:18985	*See* UCRL-JC–108738			
CONF-911296–		(Lasers '91; San Diego, CA (United States); 8-13 Dec 1991)			
5	17:19147	*See* UCRL-JC–107745			
6	17:19135	*See* LA-UR–92-896			
9	17:19149	*See* UCRL-JC–108146			
8-Rev.1	17:19104	*See* UCRL-JC–109918-Rev.1			
CONF-920104–		(9. symposium on space nuclear power systems; Albuquerque, NM (United States); 13-16 Jan 1992)			
33	17:18344	*See* EGG-M–91517			
CONF-9201100–		(International comprehensive ocean atmosphere data set (COADS) workshop; Boulder, CO (United States); 13-15 Jan 1992)			
1	17:19953	*See* UCRL-JC–109501			
CONF-9201101–		(SEAM '92: Scientific and Engineering Applications of the McIntosh technical conference and exposition; San Francisco, CA (United States); 15-17 Jan 1992)			
1	17:19225	*See* SLAC-PUB–5649			
CONF-9201104–		(Giornata di studio AEI su 'Protezione da sovratensioni delle stazioni AT'; Genoa (Italy); 29 Jan 1992)			
1	17:18584	*See* ETDE-IT–92-32			

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CONF-920113–		(8. winter workshop on nuclear dynamics; Jackson Hole, WY (United States); 18-25 Jan 1992)			
2	17:20197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011681	MF-413
3	17:20198	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011668	MF-413
CONF-920124–		(Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering; Los Angeles, CA (United States); 19-24 Jan 1992)			
19	17:20334	*See* LA-UR–92-989			
20	17:18970	*See* LA-UR–92-748			
21	17:19982	*See* UCRL-JC–107443			
22	17:18111	*See* UCRL-JC–109754			
23	17:19226	*See* SLAC-PUB–5760			
24	17:19148	*See* UCRL-JC–108127			
CONF-920126–		(13. international conference on few body problems in physics; Adelaide (Australia); 5-11 Jan 1992)			
2	17:20192	*See* LA-UR–92-742			
CONF-920140–		(30. winter meeting on nuclear physics; Bormio (Italy); 27 Jan - 1 feb 1992)			
1	17:20209	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011064	MF-413
CONF-920184–		(International Astronomical Union (IAU) meeting; Mito (Japan); 6-10 Jan 1992)			
2	17:19975	*See* LA-UR–92-879			
3	17:19974	*See* LA-UR–92-861			
CONF-9202100–		(8. annual Western regional meeting of the Alternative Natural Philosophy Association (ANPA); Stanford, CA (United States); 15-17 Feb 1992)			
1	17:19967	*See* SLAC-PUB–5752			
CONF-9202103–		(10. international colloquium on ultra violet and x-ray spectroscopy of astrophysical and laboratory plasmas; Berkeley, CA (United States); 3-5 Feb 1992)			
1	17:19984	*See* UCRL-JC–109859			
2	17:19986	*See* UCRL-JC–110303			
CONF-920219–		(6. international wire chamber conference: wire chambers - recent trends and alternative techniques; Vienna (Austria); 17-21 Feb 1992)			
1	17:19333	*See* SLAC-PUB–5745			
2	17:19334	*See* SLAC-PUB–5793			
CONF-920223–		(1992 hardened electronics and radiation technology (HEART) conference; Albuquerque, NM (United States); 24-28 Feb 1992)			
6	17:19224	*See* SAND–92-0117C			
CONF-920240–		(High T_cSUH workshop on high temperature superconductivity (HTS) materials, bulk processing and bulk applications; Houston, TX (United States); 27-28 Feb 1992)			
4	17:18944	*See* LA-UR–92-706			
CONF-920291–		(Approaches to reducing uncertainty in mass balance models for toxics: Lake Ontario study; Buffalo, NY (United States); 3 Feb - 5 mar 1992)			
1	17:19553	*See* ANL/CP–75636			
CONF-920294–		(NO_x control V conference; Long Beach, CA (United States); 9-11 Feb 1992)			
1	17:17778	*See* ANL/CP–75635			
CONF-920296–		(6. SPIE conference on medical imaging; Newport Beach, CA (United States); 23-28 Feb 1992)			
1	17:20572	*See* LA-UR–92-829			
CONF-920299–		(6. European symposium on semiconductor detectors; Milano (Italy); 24-27 Feb 1992)			
1	17:19280	*See* FNAL/C–92/66			

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CONF-920302–		(43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; New Orleans, LA (United States); 9-13 Mar 1992)			
6	17:19013	*See* Y/DK–883			
CONF-920305–		(Minerals, Metals, and Materials Society (TMS) annual meeting and exhibition; San Diego, CA (United States); 1-5 Mar 1992)			
8	17:18824	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011037	MF-404
CONF-920307–		(Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992)			
52	17:18045	*See* PNL-SA–20510			
60	17:18076	*See* WSRC-MS–91-407			
62	17:18079	*See* WSRC-MS–92-044			
63	17:18113	*See* WSRC-MS–92-060			
64	17:18080	*See* WSRC-MS–92-062			
65	17:17916	*See* SAND–91-1977C			
67	17:18055	*See* SAND–92-0091C			
68	17:18081	*See* WSRC-MS–92-063			
69	17:18037	*See* PNL-SA–20057			
70	17:18071	*See* WHC-SA–1365			
71	17:18070	*See* WHC-SA–1343			
72	17:18953	*See* ANL/CP–75684			
73	17:18112	*See* WHC-SA–1471			
CONF-920310–		(American Institute of Chemical Engineers spring meeting; New Orleans, LA (United States); 29 Mar - 2 apr 1992)			
7	17:20503	*See* DOE/METC/C–92/7010			
8	17:19150	*See* UCRL-JC–109389			
CONF-9203108–		(1992 American Society for Nondestructive Testing (ASNT) spring conference; Orlando, FL (United States); 30 Mar - 3 apr 1992)			
1	17:18798	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010471	MF-336
CONF-9203109–		(15. vertebrate pest conference; Newport, CA (United States); 5 Mar 1992)			
1	17:19567	*See* EGG–10617-2130			
CONF-920311–		(10. international conference on plasma-surface interactions in controlled fusion devices; Monterey, CA (United States); 30 Mar - 3 apr 1992)			
2	17:20359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011782	MF-421
4	17:20457	*See* PPPL-CFP–2605			
5	17:20462	*See* SAND–92-8489C			
Absts.	17:20430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012142	MF-421
CONF-9203110–		(8. international conference on advanced science and technology; Argonne, IL (United States); 28 Mar 1992)			
1	17:18923	*See* ANL/CP–75723			
CONF-9203112–		(Westinghouse GOCO symposium; Richland, WA (United States); 23-25 Mar 1992)			
1	17:18007	*See* FEMP–2264			
CONF-9203113–		(1992 spring seminar Rio Grande chapter Association of Records Managers and Administrators; Albuquerque, NM (United States); 19 Mar 1992)			
1	17:20525	*See* SAND–92-0477C			
CONF-9203118–		(Computer hardward advanced mathematics and model physics (CHAMMP) science meeting; Las Vegas, NV (United States); 17 Mar 1992)			
1	17:19394	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011902	MF-402; MF-405
CONF-9203120–		(33. weapons agencies nondestructive testing organization (WANTO) meeting; Livermore, CA (United States); 10-12 Mar 1992)			
1	17:18407	*See* WSRC-MS–92-101			
CONF-9203121–		(Pathway analysis and risk assessment for environmental compliance and dose reconstruction; Kiawah Island, SC (United States); 2-6 Mar 1992)			
1	17:18608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011047	MF-407
2	17:19872	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011036	MF-407

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CONF-9203122–		(Engineering Foundation conference on pool and external flow boiling; Santa Barbara, CA (United States); 22-27 Mar 1992)			
1	17:19113	*See* LA-UR–92-759			
2	17:19112	*See* LA-UR–92-756			
CONF-9203123–		(International workshop on calorimetry; Ispra (Italy); 23-27 Mar 1992)			
1	17:18116	*See* LA-UR–92-883			
CONF-9203124–		(3. annual diamond technology workshop; Detroit, MI (United States); 17-18 Mar 1992)			
1	17:18976	*See* SAND–91-2727C			
CONF-9203126–		(Workshop on engineering partnerships for sustainable development in conjunction with prep con IV of the United Nations conference on environment and development; New York, NY (United States); 1-3 Mar 1992)			
1	17:20625	*See* LA-UR–92-653			
CONF-9203127–		(1. international conference on intelligent materials; Oiso-Machi (Japan); 23-25 Mar 1992)			
1	17:19040	*See* SAND–92-0193C			
CONF-9203130–		(Optical Society of America (OSA) meeting; Jackson Hole, WY (United States); 2-5 Mar 1992)			
1	17:18909	*See* UCRL-JC–108838			
CONF-9203132–		(32. annual summer school and congress of the South African Association of Physicist in Medicine and Biology; Midrand (South Africa); 9-13 Mar 1992)			
	17:19807	*See* INIS-mf–13183			
CONF-9203134–		(International Studies Association annual conference; Atlanta, GA (United States); 31 Mar - 3 apr 1992)			
1	17:18815	*See* LA-UR–92-889			
CONF-9203135–		(Specialist meeting on seismic isolation technology; San Jose, CA (United States); 18-20 Mar 1992)			
1	17:18409	*See* ANL/CP–75716			
CONF-9203138–		(Engineering Foundation conference on dispersion aggregation; Palm Coast, FL (United States); 15-20 Mar 1992)			
1	17:18925	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011803	MF-332
CONF-9203139–		(Laser guide star adaptive optics workshop; Albuquerque, NM (United States); 10-12 Mar 1992)			
1	17:19349	*See* UCRL-JC–109219			
CONF-920315–		(3. European particle accelerator conference; Berlin (Germany); 24-28 Mar 1992)			
4	17:19185	*See* SLAC-PUB–5784			
5	17:19230	*See* SLAC-PUB–5780			
10	17:19227	*See* SLAC-PUB–5764			
11	17:19219	*See* LA-UR–92-899			
12	17:19183	*See* SLAC-PUB–5766			
13	17:19231	*See* SLAC-PUB–5782			
14	17:19235	*See* SSCL-Preprint–75			
15	17:19236	*See* SSCL-Preprint–76			
16	17:19239	*See* SSCL-Preprint–80			
17	17:19237	*See* SSCL-Preprint–78			
18	17:19234	*See* SSCL-Preprint–74			
19	17:19190	*See* SSCL-Preprint–72			
20	17:19238	*See* SSCL-Preprint–79			
21	17:19175	*See* BNL–46687			
22	17:19182	*See* SLAC-PUB–5747			
23	17:19228	*See* SLAC-PUB–5768			
24	17:19186	*See* SLAC-PUB–5789			
25	17:19229	*See* SLAC-PUB–5775			
26	17:19232	*See* SLAC-PUB–5806			
27	17:19187	*See* SLAC-PUB–5804			
28	17:19176	*See* BNL–47378			
29	17:19172	*See* BNL–46684			
30	17:19171	*See* BNL–46683			
31	17:19242	*See* ANL/CP–75861			

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32	17:19197	*See* ANL/CP–75862			
33	17:19170	*See* BNL–46678			
CONF-920318–		(International workshop on dynamical fluctuations and correlations in nuclear collisions; Aussois (France); 12-16 Mar 1992)			
1	17:20283	*See* UCRL-JC–110189			
CONF-920328–		(9. annual hazardous materials conference; Long Beach, CA (United States); 31 Mar - 2 apr 1992)			
1	17:19565	*See* WHC-SA–1378			
CONF-920331–		(International industrial symposium on the super collider; New Orleans, LA (United States); 4-6 Mar 1992)			
2	17:19267	*See* ANL-HEP-CP–92-13			
3	17:19324	*See* LA-UR–92-936			
CONF-920362–		(9. topical conference on high-temperature plasma diagnostics; Santa Fe, NM (United States); 15-19 Mar 1992)			
5	17:20414	*See* SAND–92-0189C			
9	17:20360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011048	MF-427
10	17:20413	*See* SAND–92-0066C			
11	17:20261	*See* SAND–92-0065C			
12	17:20459	*See* SAND–92-0049C			
13	17:20460	*See* SAND–92-0155C			
14	17:20333	*See* LA-UR–92-792			
15	17:20400	*See* LA-UR–92-837			
16	17:20399	*See* LA-UR–92-826			
17	17:20401	*See* LA-UR–92-903			
18	17:20402	*See* LA-UR–92-1043			
19	17:20451	*See* LA-UR–92-875			
20	17:20446	*See* GA-A–20860			
21	17:20374	*See* GA-A–20849			
22	17:20423	*See* UCRL-JC–108974			
23	17:20361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011691	MF-420
24	17:20376	*See* GA-A–20876			
25	17:20375	*See* GA-A–20855			
26	17:20461	*See* SAND–92-0156C			
28	17:20424	*See* UCRL-JC–109095			
CONF-920367–		(Department of Defense (DOD) fiber optics conference; McLean, VA (United States); 25 Mar 1992)			
7	17:19368	*See* UCRL-JC–107399			
CONF-920373–		(American Institute of Astronautics and Aeronautics (AIAA) space programs and technologies conference; Huntsville, AL (United States); 24-27 Mar 1992)			
2	17:19119	*See* SAND–91-1691C			
3	17:19094	*See* SAND–91-1717C			
4	17:19099	*See* SAND–92-0662C			
CONF-920375–		(Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992)			
5	17:18378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010435	
9	17:18363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011040	
10	17:18412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011070	
11	17:18379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011078	
12	17:18380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011079	
13	17:18413	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011789	
14	17:18414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013289	
CONF-920376–		(Meeting of the American Physical Society; Indianapolis, IN (United States); 16-20 Mar 1992)			
1	17:18638	*See* LA-UR–92-890			
CONF-920378–		(Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992)			
1	17:18255	*See* LA-UR–92-978			
3	17:18258	*See* LA-UR–92-1237			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-920390–		(WHP92 on heterogeneous processing; Beverly Hills, CA (United States); 23-24 Mar 1992)			
2	17:20611	*See* UCRL-JC–109774			
CONF-920395–		(Fusion energy advisory committee meeting; Princeton, NJ (United States); 18-19 Mar 1992)			
1	17:20431	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011080	MF-420
CONF-920402–		(Material Research Society spring meeting; San Francisco, CA (United States); 27 Apr - 2 may 1992)			
1	17:18986	*See* UCRL-JC–110152			
2	17:18945	*See* LA-UR–92-1426			
3	17:18946	*See* LA-UR–92-1435			
4	17:18971	*See* LA-UR–92-1370			
CONF-920407–		(3. European particle accelerator conference; Berlin (Germany); 7-11 Apr 1992)			
1	17:19174	*See* BNL–46686			
2	17:19173	*See* BNL–46685			
CONF-9204102–		(6. symposium on electromagnetic launch technology; Austin, TX (United States); 28-30 Apr 1992)			
3	17:19386	*See* SAND–91-2155C			
4	17:19387	*See* SAND–92-0460C			
5	17:19103	*See* UCRL-JC–108503			
6	17:19181	*See* SAND–91-2285C			
7	17:19241	*See* UCRL-JC–109672			
8	17:19223	*See* SAND–91-2208C			
CONF-9204103–		(The Combustion Institute, central states spring meeting on combustion fundamentals and applications; Columbus, OH (United States); 26-28 Apr 1992)			
2	17:17814	*See* DOE/METC/C–92/7013			
CONF-9204105–		(2. Organization for Economic Cooperation and Development (OECD)/Committee on the Safety of Nuclear Installations (CSNI) specialists meeting; Karlsruhe (Germany); 1-3 Apr 1992)			
7	17:18290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010990	MF-523
CONF-9204106–		(Scalable high performance computing conference; Williamsburg, VA (United States); 26-29 Apr 1992)			
3	17:20555	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011061	MF-405
CONF-9204108–		(10. American Society of Civil Engineers (ASCE) structures congress; San Antonio, TX (United States); 13-15 Apr 1992)			
1	17:18951	*See* ANL/CP–74502			
CONF-9204110–		(1992 Hazardous Materials Control Research Institute federal environmental restoration conference; Vienna, VA (United States); 15-17 Apr 1992)			
1	17:19454	*See* ANL/CP–75281			
3	17:19536	*See* PNL-SA–20550			
CONF-9204112–		(2. small satellite technology and applications; Orlando, FL (United States); 20-24 Apr 1992)			
1	17:19423	*See* LA-UR–92-949			
CONF-9204114–		(Allied-Signal Aerospace Company conference on computer aided engineering; Torrence, CA (United States); 29 Apr 1992)			
1	17:18865	*See* KCP–613-4837			
CONF-9204115–		(35. Institute for Interconnecting and Packaging Electronic Circuits (IPC) annual meeting; Bel Harbor, FL (United States); 5-10 Apr 1992)			
1	17:19139	*See* SAND–92-0271C			
CONF-9204116–		(8. annual Performance Management Association conference; San Francisco, CA (United States); 1-3 Apr 1992)			
1	17:20524	*See* SAND–92-0407C			
CONF-9204120–		(Soft-x-ray projection lithography topical meeting; Monterey, CA (United States); 6-8 Apr 1992)			
1	17:19337	*See* UCRL-JC–110134			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-920417–		(ANS executive conference on remote operations and robotics in the nuclear industry II; Pine Mountain, GA (United States); 5-8 Apr 1992)			
2	17:20432	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011777	MF-420
3	17:19080	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011772	MF-406
CONF-920423–		(7. international symposium on temperature: its measurement and control in science and industry; Toronto (Canada); 28 Apr - 1 may 1992)			
3	17:18346	*See* WHC-SA–1258			
CONF-920427–		(Energy and environment: transitions in Eastern Europe; Prague (Czechoslovakia); 20-23 Apr 1992)			
1	17:17813	*See* DOE/MC/21023–92/C0015			
CONF-920428–		(Annual international nuclear power plant simulators conference; Orlando, FL (United States); 6-9 Apr 1992)			
4	17:20550	*See* ANL/CP–75316			
CONF-920429–		(International solar energy conference; Honolulu, HI (United States); 4-8 Apr 1992)			
2	17:18253	*See* PNL-SA–19467			
CONF-920430–		(International high level radioactive waste management (IHLRWM) conference: promoting understanding through education and communication; Las Vegas, NV (United States); 12-16 Apr 1992)			
70	17:17925	*See* ANL/CP–74200			
72	17:18597	*See* ANL/CP–74094			
73	17:17926	*See* ANL/CP–74206			
74	17:18078	*See* WSRC-MS–92-017			
75	17:18040	*See* PNL-SA–20353			
76	17:18039	*See* PNL-SA–20258			
77	17:18043	*See* PNL-SA–20371			
78	17:18044	*See* PNL-SA–20380			
79	17:18042	*See* PNL-SA–20362			
80	17:18036	*See* PNL-SA–19967			
83	17:20521	*See* PNL-SA–20246			
90	17:18041	*See* PNL-SA–20361			
91	17:18035	*See* PNL-SA–19941			
CONF-920431–		(Meeting on new horizons in radiation protection and shielding; Pasco, WA (United States); 26 Apr - 1 may 1992)			
24	17:19332	*See* PNL-SA–19981			
CONF-920432–		(54. annual American power conference; Chicago, IL (United States); 13-15 Apr 1992)			
6	17:18322	*See* ANL/CP–75357			
7	17:18310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011687	MF-522
8	17:17827	*See* DOE/METC/C–92/7016			
CONF-920439–		(International conference on metallurgical coatings and thin films; San Diego, CA (United States); 6-10 Apr 1992)			
5	17:18910	*See* UCRL-JC–109024			
6	17:18819	*See* ANL/CP–74638			
CONF-920444–		(American Chemical Society national meeting; San Francisco, CA (United States); 5-10 Apr 1992)			
21	17:17773	*See* UCRL-JC–109210			
22	17:19048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011665	MF-401
23	17:17723	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011746	MF-108
24	17:19461	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011550	MF-101
25	17:19462	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011551	MF-101
26	17:19395	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011788	MF-407
27	17:18973	*See* PNL-SA–20358			
28	17:17724	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013222	MF-108
CONF-920445–		(25. anniversary meeting of the Dielectric Society with the 2nd European conference on applications of polar dielectrics and international workshop on integrated ferroelectrics; London (United Kingdom); 12-15 Apr 1992)			
1	17:18950	*See* SAND–92-0864C			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-920448–		(94. annual meeting and exposition of the American Ceramic Society; Minneapolis, MN (United States); 12-16 Apr 1992)			
1	17:18038	*See* PNL-SA–20212			
CONF-920458–		(Corrosion '92 conference and exhibition; Nashville, TN (United States); 27 Apr - 1 may 1992)			
5	17:17810	*See* ANL/CP–75224			
6	17:19358	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011679	
7	17:20433	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011783	MF-423
CONF-920462–		(Workshop on disabsorption induced by electronic transitions; Taos, NM (United States); 1-4 Apr 1992)			
1	17:20337	*See* UCRL-JC–110159			
CONF-920466–		(Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992)			
2	17:18006	*See* FEMP–2262			
3	17:18005	*See* FEMP–2260			
4	17:20620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011092	MF-940
5	17:18431	*See* LA-UR–92-1086			
6	17:20554	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011677	MF-902
7	17:17937	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011765	MF-902
8	17:18629	*See* SAND–92-0247C			
CONF-920468–		(DOE ALARA workshop; Upton, NY (United States); 21-22 Apr 1992)			
1	17:18106	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011784	MF-407
CONF-920471–		(International Society for Photo Optical Engineering (SPIE) conference; Orlando, FL (United States); 20-24 Apr 1992)			
4	17:19524	*See* LA-UR–92-985			
CONF-920480–		(International conference on liquid radiation detectors: their fundamental properties and applications; Tokyo (Japan); 7-10 Apr 1992)			
1	17:19270	*See* BNL–47420			
CONF-920494–		(Association for Quality and Participation (AQP) annual spring conference; Seattle, WA (United States); 6-9 Apr 1992)			
3	17:20515	*See* KCP–613-4849			
4	17:20516	*See* KCP–613-4854			
CONF-9205106–		(9. engineering mechanics conference of American Society of Civil Engineers (ASCE); College Station, TX (United States); 24-27 May 1992)			
2	17:19523	*See* LA-UR–92-971			
CONF-9205109–		(International conference on nuclear structure at high angular momentum; Ottawa (Canada); 18-21 May 1992)			
1	17:20172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011063	MF-413
3	17:20173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011066	MF-413
CONF-9205127–		(Institute of Environmental Sciences symposium; Nashville, TN (United States); May 1992)			
2	17:19356	*See* SAND–92-0518C			
CONF-9205128–		(Symposium on assessments of quality software development tools; New Orleans, LA (United States); 27-29 May 1992)			
2	17:20567	*See* KCP–613-4742			
CONF-9205130–		(DOE computer security group conference; Las Vegas, NV (United States); 4-7 May 1992)			
1	17:20560	*See* EGG–10617-6085			
CONF-9205132–		(International conference on practical tribology; Moscow (USSR); 4-9 May 1992)			
1	17:18921	*See* ANL/CP–75375			
CONF-9205133–		(1992 technical Association of Pulp and Paper Manufacturers (APPM) conference; Marcos Island, FL (United States); 11-13 May 1992)			
1	17:18952	*See* ANL/CP–75282			
CONF-9205134–		(8. international roofing and waterproofing congress; Madrid (Spain); 20-22 May 1992)			
1	17:18688	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010544	MF-350

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-9205135–		(1992 ABAQUS user's meeting; Newport, RI (United States); 27-29 May 1992)			
1	17:18570	*See* WSRC-MS–92-035			
CONF-9205136–		(1992 international geoscience and remote sensing symposium; Houston, TX (United States); 26-29 May 1992)			
1	17:19323	*See* LA-UR–92-764			
2	17:19520	*See* LA-UR–92-708			
3	17:19521	*See* LA-UR–92-709			
CONF-9205137–		(International seminar on physics and gas dynamics and shock waves; Minsk (USSR); 27 May - 2 jun 1992)			
1	17:18890	*See* LA-UR–92-667			
CONF-9205138–		(North American Ingres Users Association (NAIUA) meeting; Tarpan Springs, FL (United States); May 1992)			
1	17:20573	*See* LA-UR–92-1048			
2	17:20598	*See* SAND–91-2790C			
CONF-9205139–		(Symposium on automation of mechanical testing; Pittsburgh, PA (United States); 20-21 May 1992)			
1	17:19118	*See* LA-UR–92-958			
CONF-920514–		(181. meeting of the Electrochemical Society, Inc.; St. Louis, MO (United States); 17-22 May 1992)			
3	17:18975	*See* SAND–91-2693C			
CONF-9205140–		(3. international workshop on transducers for sonics and ultrasonics; Orlando, FL (United States); 6-8 May 1992)			
1	17:18679	*See* LA-UR–92-869			
CONF-9205141–		(Ideas in science and electronics symposium; Albuquerque, NM (United States); 14 May 1992)			
1	17:19143	*See* SAND–92-0816C			
2	17:19095	*See* SAND–91-2350C			
CONF-9205142–		(11. international conference on vacuum metallurgy; No City Given (France); 11-14 May 1992)			
1	17:18896	*See* SAND–92-0594C			
CONF-9205143–		(1992 Association for Computing Machines (ACM) conference on human factor on computer systems; Monterey, CA (United States); 3-7 May 1992)			
1	17:20604	*See* UCRL-JC–108993			
CONF-9205144–		(Dynamic behavior of radionuclides in forests; Stockholm (Sweden); 18-22 May 1992)			
1	17:19463	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011774	MF-402
CONF-9205145–		(11. symposium on engineering applications of mechanics; Saskatchewan (Canada); 11 May 1992)			
1	17:18319	*See* BNL–47331			
CONF-9205146–		(6. international symposium on structural adhesive bonding; Morristown, NJ (United States); 4-7 May 1992)			
1	17:18984	*See* UCRL-JC–107317			
CONF-9205148–		(Mid-America Chinese professional annual convention; Itasca, IL (United States); 29-31 May 1992)			
1	17:19455	*See* ANL/CP–75814			
CONF-920527–		(Incineration conference; Albuquerque, NM (United States); 11-14 May 1992)			
1	17:19350	*See* ANL/CP–75957			
2	17:19396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013287	MF-902
CONF-920538–		(8. power plant dynamics, control and testing symposium; Knoxville, TN (United States); 27-29 May 1992)			
3	17:18294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010122	MF-502
7	17:18324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011142	MF-530
9	17:18393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011062	MF-406
10	17:18415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011109	MF-406
11	17:18394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011105	MF-406

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13	17:18416	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011678	MF-406
14	17:18377	*See* ANL/CP–75747			
15	17:18371	*See* ANL/CP–72713			
15	17:18372	*See* ANL/CP–72713			
15	17:18374	*See* ANL/CP–74392			
16	17:20548	*See* ANL/CP–74367			
17	17:18360	*See* WHC-SA–1323			
18	17:20497	*See* ANL/CP–75335			
19	17:18373	*See* ANL/CP–74391			
20	17:18376	*See* ANL/CP–74461			
21	17:18375	*See* ANL/CP–74459			
22	17:18417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013406	MF-506
23	17:18381	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013410	MF-506
24	17:18382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013232	MF-520; MF-506
CONF-920540–		(1992 Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics and automation; Nice (France); 10-15 May 1992)			
16	17:18759	*See* SAND–92-0520C			
CONF-920560–		(3. international symposium on the biological processing of coal; Clearwater, FL (United States); 4-7 May 1992)			
1	17:17725	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011685	MF-108
CONF-920573–		(CLEO/QELS '92; Anaheim, CA (United States); 10-17 May 1992)			
7	17:19151	*See* UCRL-JC–110158			
8	17:19011	*See* SAND–92-8495C			
CONF-920604–		(7. world conference and exhibition on titanium; San Diego, CA (United States); 28 Jun - 2 jul 1992)			
1	17:18889	*See* LA-UR–92-659			
2	17:18891	*See* LA-UR–92-887			
CONF-920606–		(American Nuclear Society annual meeting; Boston, MA (United States); 7-12 Jun 1992)			
14	17:18077	*See* WSRC-MS–91-560			
15	17:18342	*See* WHC-SA–1376			
16	17:20487	*See* UCRL-JC–109517			
CONF-920607–		(10. topical meeting on technology of fusion energy; Boston, MA (United States); 7-12 Jun 1992)			
5	17:20434	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010686	MF-420
6	17:20489	*See* UCRL-JC–109808			
7	17:20490	*See* UCRL-JC–109811			
9	17:20435	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011790	MF-426
10	17:20488	*See* UCRL-JC–109522			
11	17:20482	*See* UCRL-CR–109550			
12	17:20491	*See* UCRL-JC–109816			
13	17:20486	*See* UCRL-JC–109337			
CONF-9206102–		(Innovative applications of artificial intelligence; International joint conference on neural networks; San Jose, CA (United States); Baltimore, MD (United States); 13-15 Jul 1992; 7-11 jun 1992)			
1	17:19361	*See* LA-UR–92-104			
CONF-9206114–		(Annual meeting of the Air and Waste Management Association (AWMA); Kansas City, MO (United States); 21-26 Jun 1992)			
5	17:18636	*See* SAND–92-0523C			
6	17:19464	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011773	MF-402
7	17:19444	*See* UCRL-JC–109830			
CONF-9206135–		(1992 international thermal spray conference; Orlando, FL (United States); 1-5 Jun 1992)			
2	17:18880	*See* IS-M–700			
CONF-9206139–		(C31 technology and applications; Rome, NY (United States); 1-4 Jun 1992)			
1	17:19977	*See* SAND–92-0390C			
CONF-9206141–		(1992 Optics international conference; Padova (Italy); 9-12 Jun 1992)			
1	17:18978	*See* SAND–92-0393C			

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CONF-9206142–		(1. surface roughness and scattering; Tucson, AZ (United States); 1-3 Jun 1992)			
1	17:19342	*See* BNL–47220			
CONF-9206151–		(Technology Transfer Society (TTS) conference; Athens, GA (United States); 24-26 Jun 1992)			
1	17:20527	*See* SAND–92-0810C			
CONF-9206152–		(1992 international joint technology workshop on fuzzy logic and neural networks; Houston, TX (United States); 1-3 Jun 1992)			
1-Extd.Abst.	17:20556	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011688	MF-405
CONF-9206153–		(48. annual forum and technology display of the American Helicopter Society (AHS); Washington, DC (United States); 3-5 Jun 1992)			
1	17:19369	*See* UCRL-JC–109718			
CONF-9206155–		(1992 Canadian Society for Mechanical Engineering (CSME): Transport 1992+; Montreal (Canada); 1-5 Jun 1992)			
1	17:18723	*See* ANL/CP–74864			
CONF-9206156–		(11. conference on automated deduction; Saratoga Springs, NY (United States); 15-18 Jun 1992)			
1	17:20549	*See* ANL/CP–74903			
CONF-920628–		(International conference on carbon: carbon '92; Essen (Germany); 22-26 Jun 1992)			
2-Extd.Abst.	17:20436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011778	MF-423
CONF-920631–		(American Society of Mechanical Engineers pressure vessel and piping conference; New Orleans, LA (United States); 21-25 Jun 1992)			
16	17:18825	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010431	MF-404
17	17:18405	*See* WSRC-MS–91-269			
18	17:18571	*See* WSRC-MS–92-052			
19	17:18410	*See* ANL/CP–75769			
20	17:19107	*See* WHC-SA–1396			
21	17:18573	*See* WSRC-MS–92-124			
22	17:18323	*See* ANL/CP–75478			
23	17:18572	*See* WSRC-MS–92-066			
27	17:19079	*See* ANL/CP–75215			
28	17:18289	*See* ANL/CP–73465			
29	17:18568	*See* WSRC-MS–91-270			
31	17:18408	*See* ANL/CP–75640			
CONF-920633–		(Fractured and jointed rock masses conference; Lake Tahoe, CA (United States); 3-5 Jun 1992)			
1	17:18054	*See* SAND–91-1730C			
CONF-920634–		(33. US symposium on rock mechanics; Santa Fe, NM (United States); 8-10 Jun 1992)			
11	17:19952	*See* UCRL-JC–108315			
CONF-920653–		(2. international offshore and polar engineering conference; San Francisco, CA (United States); 14-19 Jun 1992)			
1	17:17877	*See* DOE/METC/C–92/7011			
CONF-920669–		(35. international power sources symposium; Cherry Hill, NJ (United States); 22-25 Jun 1992)			
4	17:19142	*See* SAND–92-0736C			
CONF-920673–		(16. annual symposium of American Society of Testing and Materials (ASTM); Denver, CO (United States); 21-22 Jun 1992)			
3-Extd.Abst.	17:20437	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011670	MF-423
CONF-920676–		(Electronic materials conference; Cambridge, MA (United States); 24-26 Jun 1992)			
1	17:18977	*See* SAND–92-0384C			
CONF-920678–		(National solar energy conference; Cocoa Beach, FL (United States); 13-18 Jun 1992)			
2	17:19343	*See* DOE/ER/61072–4			
CONF-920701–		(10. international congress on catalysis; Budapest (Hungary); 19-24 Jul 1992)			
1	17:19035	*See* LA-UR–92-40			

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CONF-920703–		(International conference on ion exchange advances; Cambridge (United Kingdom); 12-17 Jul 1992)			
1	17:18969	*See* LA-UR–91-3097			
CONF-920707–		(24. international symposium on combustion; Sydney (Australia); 5-10 Jul 1992)			
1	17:19066	*See* SAND–91-8714			
2	17:19038	*See* SAND–91-8706			
4	17:19065	*See* SAND–91-8712			
5	17:19067	*See* SAND–91-8718			
6	17:17823	*See* SAND–91-8715			
7	17:17772	*See* SAND–91-8719			
8	17:17825	*See* SAND–91-8717			
9	17:17875	*See* SAND–91-8721			
10	17:19070	*See* SAND–91-8733			
11	17:19072	*See* SAND–91-8743			
12	17:17824	*See* SAND–91-8716			
13	17:19069	*See* SAND–91-8732			
14	17:19071	*See* SAND–91-8742			
15	17:19068	*See* SAND–91-8720			
16	17:17771	*See* SAND–91-2695C			
17	17:19014	*See* BNL–46985			
18	17:19059	*See* BNL–46958			
19	17:19073	*See* UCRL-JC–109055			
20	17:19074	*See* UCRL-JC–109083			
21	17:19060	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008736	MF-401
22-Rev.1	17:18216	*See* UCRL-JC–106910-Rev.1			
23	17:19076	*See* UCRL-JC–109757			
24	17:18801	*See* UCRL-JC–109673			
25	17:19075	*See* UCRL-JC–109756			
26	17:19064	*See* LBL–31590			
27	17:19375	*See* UCRL-JC–108986			
28	17:19374	*See* UCRL-JC–108985			
CONF-920716–		(Nuclear and space radiation effects conference; New Orleans, LA (United States); 13-17 Jul 1992)			
1	17:19340	*See* SAND–92-0357C			
2	17:19140	*See* SAND–92-0377C			
3	17:19341	*See* SAND–92-0382C			
4	17:19339	*See* SAND–92-0344C			
CONF-920724–		(1992 Institute of Electrical and Electronic Engineers (IEEE) international conference on intelligent robots and systems; Raleigh, NC (United States); 7-10 Jul 1992)			
1	17:19081	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000424	MF-406
2	17:19082	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004464	MF-406
CONF-920730–		(ACM SIGARCH international conference on supercomputing; Washington, DC (United States); 19-24 Jul 1992)			
1	17:20608	*See* UCRL-JC–109496			
2	17:20606	*See* UCRL-JC–109251			
3	17:20571	*See* LA-UR–92-805			
CONF-920740–		(9. international machine learning conference; Aberdeen (United Kingdom); 1-3 Jul 1992)			
1	17:19096	*See* SAND–91-2808C			
CONF-920747–		(28. joint propulsion conference; Nashville, TN (United States); 6-8 Jul 1992)			
1-Extd.Abst.	17:19359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006608	
CONF-920750–		(Institute of Electrical and Electronic Engineers-American Physical Society (IEEE-APS) international symposium; Chicago, IL (United States); 18-25 Jul 1992)			
1	17:20609	*See* UCRL-JC–109505			
2	17:19972	*See* LA-UR–92-296			
3	17:19976	*See* SAND–91-2910C			
CONF-920758–		(Innovative applications of artificial intelligence; International joint conference on neural networks; San Jose, CA (United States); Baltimore, MD (United States); 13-15 Jul 1992; 7-11 jun 1992)			
1	17:19361	*See* LA-UR–92-104			

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CONF-920759–		(Siggraph '92; Chicago, IL (United States); 26-31 Jul 1992)			
1	17:20610	*See* UCRL-JC–109659			
CONF-920760–		(International symposium on symbolic and algebraic computation; Berkeley, CA (United States); 27-29 Jul 1992)			
1	17:20607	*See* UCRL-JC–109266			
2	17:20603	*See* UCRL-JC–108973			
3	17:20605	*See* UCRL-JC–109225			
CONF-920761–		(7. water-rock interaction conference; Park City, UT (United States); 9-23 Jul 1992)			
1	17:18023	*See* LA-UR–92-461			
3	17:19537	*See* SAND–92-0532C			
4	17:19016	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010448	MF-401
5	17:19017	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010542	MF-401
6	17:18259	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010641	MF-403
7	17:19018	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010886	MF-401
8	17:19941	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010432	MF-403; MF-250
9	17:18988	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011042	MF-401
10	17:19525	*See* LA-UR–92-1004			
11	17:19522	*See* LA-UR–92-924			
12	17:17829	*See* LA-UR–92-895			
CONF-920771–		(1992 summer computer simulation conference; Reno, NV (United States); 27-30 Jul 1992)			
1	17:19367	*See* SAND–92-0404C			
2	17:19371	*See* UCRL-JC–109840			
3	17:19370	*See* UCRL-JC–109817			
CONF-920872–		(13. international conference on Raman spectroscopy; Wuerzburg (Germany); 31 Aug - 4 sep 1992)			
2	17:18990	*See* ETDE-IT–92-19			
CORR–					
87-0117-Rev.3	17:17938	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013123	MF-702
CRIE-W–					
90017	17:17726	OSTI; NTIS (US Sales Only)		DE92514551	
90021	17:18926	OSTI; NTIS (US Sales Only)		DE92514552	
90022	17:17727	OSTI; NTIS (US Sales Only)		DE92514553	
90023	17:17812	OSTI; NTIS (US Sales Only)		DE92514554	
90031	17:17728	OSTI; NTIS (US Sales Only)		DE92514555	
90032	17:17729	OSTI; NTIS (US Sales Only)		DE92514556	
91002	17:18739	OSTI; NTIS (US Sales Only)		DE92514550	
CSNSM-T–					
88-01	17:19942	OSTI; NTIS (US Sales Only); INIS		DE92517879	
CTH-IEFT-PP–					
1991-23	17:20362	OSTI; NTIS (US Sales Only); INIS		DE92625097	
DESY–					
91-109	17:20070	OSTI; NTIS (US Sales Only); INIS		DE92516967	
91-128(rev.ed.)	17:20071	OSTI; NTIS (US Sales Only); INIS		DE92517037	
91-140	17:20072	OSTI; NTIS (US Sales Only); INIS		DE92516966	
91-145	17:20140	OSTI; NTIS (US Sales Only); INIS		DE92516971	
91-146	17:19254	OSTI; NTIS (US Sales Only); INIS		DE92516977	
91-151	17:20021	OSTI; NTIS (US Sales Only); INIS		DE92516965	
91-152	17:19989	OSTI; NTIS (US Sales Only); INIS		DE92516964	
91-153	17:19202	OSTI; NTIS (US Sales Only); INIS		DE92516969	
91-154	17:20073	OSTI; NTIS (US Sales Only); INIS		DE92516963	
91-155	17:20074	OSTI; NTIS (US Sales Only); INIS		DE92516979	
92-004	17:20075	OSTI; NTIS (US Sales Only); INIS		DE92517033	
92-005	17:20076	OSTI; NTIS (US Sales Only); INIS		DE92517039	
92-006	17:19990	OSTI; NTIS (US Sales Only); INIS		DE92517041	
92-007	17:20077	OSTI; NTIS (US Sales Only); INIS		DE92517040	
92-008	17:20078	OSTI; NTIS (US Sales Only); INIS		DE92517035	
92-009	17:20079	OSTI; NTIS (US Sales Only); INIS		DE92517036	
92-013	17:20080	OSTI; NTIS (US Sales Only); INIS		DE92517044	
92-014	17:20081	OSTI; NTIS (US Sales Only); INIS		DE92517042	
92-015	17:19991	OSTI; NTIS (US Sales Only); INIS		DE92517043	
DGEN-MN–					
92-3	17:19579	OSTI; NTIS (US Sales Only); INIS		DE92626566	
DOE-HMIP-RR–					
90.069	17:17940	OSTI; NTIS (US Sales Only); INIS		DE92628328	
91.012	17:17941	OSTI; NTIS (US Sales Only); INIS		DE92628321	

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91.013	17:17942	OSTI; NTIS (US Sales Only); INIS		DE92628322	
91.036	17:17943	OSTI; NTIS (US Sales Only); INIS		DE92628329	
91.043	17:17944	OSTI; NTIS (US Sales Only); INIS		DE92627048	
91.048	17:17945	OSTI; NTIS (US Sales Only); INIS		DE92628330	
91.059	17:19556	OSTI; NTIS (US Sales Only); INIS		DE92626183	
91.060	17:18095	OSTI; NTIS (US Sales Only); INIS		DE92628022	
92.004	17:18311	OSTI; NTIS (US Sales Only); INIS		DE92628214	
92.006	17:17946	OSTI; NTIS (US Sales Only); INIS		DE92628331	
92.007	17:17947	OSTI; NTIS (US Sales Only); INIS		DE92628332	
92.009	17:17948	OSTI; NTIS (US Sales Only); INIS		DE92628333	
DOE-RW–					
90.089	17:17958	OSTI; NTIS (US Sales Only); INIS		DE92628323	
90.092	17:17959	OSTI; NTIS (US Sales Only); INIS		DE92628324	
DOE/AD–					
0019	17:20499	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012408	MF-900
DOE/BC/14260–					
10-App.-Vol.1	17:17834	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001024	PC-122
10-App.-Vol.2	17:17835	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001025	PC-122
DOE/BP–					
1217	17:18689	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013350	MF-350
1523	17:18226	*See* DOE/EIS–0156			
1687	17:18690	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011543	MF-920
1729	17:18632	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011278	MF-900
1739-Vol.2	17:18787	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011542	MF-920
1785	17:18222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013335	MF-900
1787	17:18691	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013340	MF-920
1818	17:18282	*See* DOE/EIS–0162-Summ.			
DOE/BP/10392–					
1	17:18692	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011097	MF-350
DOE/BP/64840–					
3	17:18223	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011098	MF-902
DOE/BU–					
0003	17:20500	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012651	PC-900
DOE/CE–					
0350	17:18684	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012387	MF-350
0355P	17:18796	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012446	MF-350
92013169	17:18809	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013169	MF-334
DOE/CE/15517–					
T2	17:17836	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011617	MF-310
DOE/CH/10093–					
86	17:18633	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91002106	MF-233
90	17:18634	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002110	MF-233
DOE/CH/10224–					
T3	17:18693	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011578	MF-350
DOE/CH/10441–					
1	17:17905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011425	MF-820
DOE/CH/10461–					
1	17:18740	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011005	MF-310
DOE/DP–					
0098T	17:18418	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011888	MF-700
0099T	17:19465	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011738	MF-703
DOE/DP/40200–					
188	17:20438	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011614	MF-712
196	17:20263	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011316	MF-712
DOE/EA–					
0457	17:18220	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012185	MF-630
0468	17:18107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013378	MF-902
0476	17:18108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012181	MF-630
0501	17:19466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012192	MF-630
0538	17:17906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012193	MF-502; MF-630
0542	17:19397	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012183	MF-702
0545	17:19467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012190	MF-702
0546	17:19398	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012266	MF-630
0547	17:19468	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012188	MF-702
0598	17:18585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012637	MF-630
0601	17:17863	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012189	MF-126
92012182	17:18609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012182	MF-630
DOE/EH–					
0189P	17:18610	OSTI (Free of Charge)		TI92012581	MF-630
0225P	17:20501	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012391	MF-600

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0226P	17:19155	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012436	MF-600
0228	17:17893	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012437	MF-630
0240P	17:17939	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011740	MF-630
0244	17:20502	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012682	MF-630
0246	17:18109	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012238	PC-630
231-002/0191-CERCLA	17:18611	OSTI (Free of Charge)		TI92012608	MF-630
231-002/0191-RCRA	17:18612	OSTI (Free of Charge)		TI92012609	MF-630
231-006/0891	17:19940	OSTI (Free of Charge)		TI92012440	MF-630
231-007/1291	17:18613	OSTI (Free of Charge)		TI92012447	MF-630
231-008/0991	17:18614	OSTI (Free of Charge)		TI92012441	MF-630
231-008/1291	17:18615	OSTI (Free of Charge)		TI92012448	MF-630
231-009/1291	17:18616	OSTI (Free of Charge)		TI92012606	MF-630
231-009/1291-RCRA	17:18617	OSTI (Free of Charge)		TI92012607	MF-630
231-010/1291	17:18618	OSTI (Free of Charge)		TI92012611	MF-630
231-010/1291-RCRA	17:18619	OSTI (Free of Charge)		TI92012610	MF-630
231-011/0192	17:18620	OSTI (Free of Charge)		TI92012445	MF-630
DOE/EI/22786–					
T1	17:17853	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013025	MF-950
DOE/EIA–					
0035(92/03)	17:18665	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92011251	MF-950
0109(92/03)	17:17854	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92011454	MF-950
0130(92/03)	17:17879	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92011455	MF-950
0174(90)	17:18232	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92012428	MF-950
0226(91/12)	17:18658	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92012427	MF-950
0226(92/03)	17:18659	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92012426	MF-950
0469(90)	17:18666	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012425	MF-950
0520(92/03)	17:18654	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92011453	MF-950
0538(91/92-22)	17:17855	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012389	MF-950
0538(91/92-25)	17:17856	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012390	MF-950
0543(91/4Q)	17:18655	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92011625	MF-950
0555(92)/1	17:18667	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92012432	MF-950
DOE/EIS–					
0131-Vol.1-Final	17:18281	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012663	MF-630
0131-Vol.2-Final	17:18224	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012664	MF-630
0131-Vol.3-Final	17:18284	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012665	MF-630
0131-Vol.4-Final	17:18225	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012666	MF-630
0156	17:18226	OSTI;NTIS; GPO Dep.	E 1.99:	DE91007408	MF-225
0162-Summ.	17:18282	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011117	MF-902
DOE/ER–					
0533P	17:20621	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012384	MF-400
0541T	17:19399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013750	PC-402
DOE/ER/00038–					
3487	17:19044	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011830	MF-401
DOE/ER/12119–					
1	17:18956	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011940	MF-401
DOE/ER/12894–					
3	17:18343	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013402	MF-406
DOE/ER/13262–					
8	17:20278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012658	MF-411
DOE/ER/13263–					
8	17:19019	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011347	MF-401
DOE/ER/13318–					
T1	17:18741	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011576	MF-401
DOE/ER/13403–					
4	17:18957	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011632	MF-401
DOE/ER/13469–					
T2	17:19020	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013503	MF-401
DOE/ER/13506–					
37	17:18233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011115	MF-401
DOE/ER/13539–					
3	17:19572	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010791	MF-408
DOE/ER/13566–					
5	17:18826	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012241	MF-404
DOE/ER/13590–					
10	17:20284	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012668	MF-401
DOE/ER/13633–					
11	17:19041	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011808	MF-401
DOE/ER/13634–					
2	17:20285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010658	MF-411

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DOE/ER/13657–					
T1	17:19021	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011427	MF-406
DOE/ER/13700–					
T2	17:20286	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010770	MF-401
DOE/ER/13705–					
T2	17:19573	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012231	MF-408
DOE/ER/13707–					
2	17:19576	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012123	MF-408
DOE/ER/13711–					
5	17:18958	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012597	MF-403
DOE/ER/13738–					
T2	17:20291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013502	MF-410
DOE/ER/13747–					
11	17:19469	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011128	MF-403
DOE/ER/13775–					
3	17:19022	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012539	MF-401
T1	17:19023	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012538	MF-401
DOE/ER/13812–					
T1	17:19061	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012573	MF-401
DOE/ER/13842–					
T2	17:19024	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012228	MF-401
DOE/ER/13852–					
192	17:19045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011807	MF-401
DOE/ER/13859–					
31	17:18927	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011129	MF-401
DOE/ER/13911–					
T2	17:19109	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012574	MF-401
DOE/ER/13965–					
4	17:20272	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011026	MF-411
DOE/ER/13973–					
5	17:19130	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013493	MF-406
DOE/ER/14004–					
3	17:19569	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010795	MF-408
DOE/ER/14049–					
T1	17:19943	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012239	MF-403
T2	17:18256	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012579	MF-403
DOE/ER/14066–					
T2	17:20273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013523	MF-411
DOE/ER/14083–					
1	17:18257	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010950	MF-403
DOE/ER/14176–					
T1	17:19971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011853	MF-411
DOE/ER/14189–					
1	17:19062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013484	MF-411
DOE/ER/14192–					
1	17:19063	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011433	MF-401
DOE/ER/14194–					
1	17:19944	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012315	MF-403
DOE/ER/20003–					
1	17:19574	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012316	MF-408
DOE/ER/20006–					
1	17:19570	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011937	MF-408
DOE/ER/25024–					
2	17:20557	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010660	MF-405
DOE/ER/25086–					
2	17:20250	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011432	MF-405
DOE/ER/25099–					
1	17:20264	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010934	MF-405
DOE/ER/25105–					
1	17:20558	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011939	MF-405
DOE/ER/40107–					
11(B)	17:19992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012240	MF-414
DOE/ER/40125–					
32	17:19274	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010796	MF-414
DOE/ER/40159–					
182	17:20174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012598	MF-413
DOE/ER/40171–					
4	17:19275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013499	MF-414
DOE/ER/40283–					
T2	17:20164	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011629	MF-413

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/ER/40328–					
T1	17:20165	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011221	MF-413
DOE/ER/40452–					
6	17:19276	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011603	MF-412
DOE/ER/40583–					
T2	17:19203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011125	MF-414
DOE/ER/40625–					
T1	17:19177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013726	MF-414
DOE/ER/40627–					
1	17:19987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011854	MF-413
DOE/ER/40628–					
1	17:19993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011035	MF-414
DOE/ER/40652–					
1	17:20022	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011436	MF-414
DOE/ER/40670–					
1	17:19277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011941	MF-414
DOE/ER/45125–					
9	17:19025	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011633	MF-408
DOE/ER/45182–					
6	17:18827	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011907	MF-404
DOE/ER/45208–					
7	17:20329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011810	MF-411
DOE/ER/45297–					
28	17:18928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011461	MF-404
DOE/ER/45309–					
4	17:18929	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011570	MF-404
DOE/ER/45332–					
T1	17:18828	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012572	MF-406
DOE/ER/45372–					
4	17:18930	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013401	MF-404
DOE/ER/45375–					
T1	17:18959	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012600	MF-404
DOE/ER/45394–					
3	17:18931	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011811	MF-401
DOE/ER/45403–					
3	17:18829	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012136	MF-404
DOE/ER/45419–					
2	17:18960	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011751	MF-401
DOE/ER/45433–					
1	17:18830	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011431	MF-404
DOE/ER/52147–					
5	17:20439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011424	MF-421
DOE/ER/53214–					
2	17:20363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013153	MF-420
T1	17:20364	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013133	MF-420
DOE/ER/53250–					
3	17:20365	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012376	MF-420
5	17:20366	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012377	MF-420
DOE/ER/54091–					
1	17:20440	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011942	MF-427
DOE/ER/54131–					
1	17:20367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011806	MF-427
DOE/ER/60219–					
T2	17:19580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013154	MF-408
DOE/ER/60247–					
T1	17:19470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013520	MF-402
DOE/ER/60314–					
10	17:19400	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011602	MF-402
T3	17:19401	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011601	MF-402
DOE/ER/60319–					
T1	17:19945	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011419	MF-403
DOE/ER/60621–					
5	17:19873	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013002	MF-408
DOE/ER/60673–					
T3	17:19571	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011630	MF-408
DOE/ER/60719–					
T1	17:19581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012504	MF-408
DOE/ER/60981–					
2	17:19554	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011856	MF-402
DOE/ER/60982–					
2	17:19555	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013064	MF-403

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DOE/ER/61013–					
2	17:19946	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011752	MF-403
DOE/ER/61066–					
T1	17:19947	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010951	MF-402
DOE/ER/61072–					
2	17:19402	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011438	MF-402
4	17:19343	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011437	MF-402; MF-406
DOE/ER/61136–					
1	17:19575	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011030	MF-408
DOE/ER/61202–					
1	17:19948	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011805	MF-403
DOE/ER/61219–					
1	17:19403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012595	MF-402
DOE/ER/61220–					
1	17:19404	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011031	MF-402
DOE/ER/61229–					
1	17:19344	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013485	MF-406
DOE/ER/75564–					
9	17:18637	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011905	MF-404
DOE/ET/10815–					
173	17:18673	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011025	MF-112
T34	17:18674	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011024	MF-112
DOE/ET/53088–					
530	17:20368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012138	MF-420
541	17:20369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012139	MF-426
DOE/FE–					
0244P	17:17826	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012429	MF-101
0245	17:17874	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012433	MF-126
0251P	17:17880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012383	MF-131
0252T	17:18656	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013596	MF-101
DOE/ID–					
10291	17:18419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012356	MF-523
10338	17:18217	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012225	MF-225
10376	17:18221	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013597	MF-225
12123	17:19471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012364	MF-902
22099	17:18096	OSTI; NTIS; U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225; GPO Dep.	E 1.99:	DE92012360	MF-702
DOE/IE/10859–					
T3	17:18621	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011901	MF-900
DOE/IG–					
0306	17:18599	OSTI (Free of Charge)		TI92013747	PC-960
DOE/LLW–					
147	17:17950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012308	MF-902
65T	17:17949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012623	MF-721
DOE/MC/11076–					
3061	17:17730	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001142	MF-109
3062	17:17731	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001143	MF-109
3072	17:17886	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001257	MF-123
3073	17:17784	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001258	MF-107
DOE/MC/11089–					
92/C0007	17:17890	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011200	MF-123
DOE/MC/21023–					
92/C0015	17:17813	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012133	MF-103
DOE/MC/23075–					
3079	17:17732	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012186	MF-109
3081	17:17733	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001267	MF-113
DOE/MC/23167–					
3056	17:18272	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001119	PC-111
3065	17:18273	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001145	PC-111
DOE/MC/24266–					
3069-Vol.2	17:17734	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001251	PC-109
DOE/MC/24268–					
3075	17:17735	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001261	MF-109
DOE/MC/25003–					
3045	17:17736	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001121	PC-106
DOE/MC/25006–					
3057	17:17737	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001138	PC-106
DOE/MC/26019–					
3071	17:18274	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001254	PC-109

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/MC/26268–					
3039	17:17885	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001113	PC-123
92/C0012	17:17887	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012545	MF-123
DOE/METC/C–					
92/7010	17:20503	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010529	MF-101
92/7011	17:17877	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010528	MF-132
92/7013	17:17814	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011756	MF-103; MF-104
92/7016	17:17827	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011754	MF-101
DOE/MI/10158–					
1	17:20504	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011936	MF-900
DOE/NE/44139–					
48	17:17951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012577	PC-510
66	17:18797	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012578	PC-510
DOE/NV–					
296-Rev.1	17:19376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012298	PC-700
DOE/NV/10031–					
T1	17:18805	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011631	MF-333
DOE/NV/10630–					
26	17:17952	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011832	MF-721
DOE/NV/10845–					
9	17:19472	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012690	MF-703
DOE/OR/21555–					
T2	17:17907	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011923	MF-812
T3	17:18119	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011924	MF-812
T3-Suppl.	17:18120	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011925	MF-812
T4	17:17908	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011926	MF-812
T5	17:17909	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011927	MF-812
T6	17:17910	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011928	MF-812; MF-820
T7	17:17911	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011929	MF-812
T8	17:17912	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011930	MF-812
T9	17:17913	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011931	MF-812
DOE/PC–					
92011471	17:17800	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011471	MF-101
92011472	17:17821	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011472	MF-101
92011473	17:17770	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011473	MF-101
92011597	17:17822	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011597	MF-101
DOE/PC/79743–					
T3	17:17815	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013483	MF-105
DOE/PC/79796–					
T18	17:17785	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011623	MF-104
DOE/PC/79816–					
T3	17:17738	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011275	PC-108
DOE/PC/79818–					
T5	17:17739	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012555	MF-108
T7	17:17740	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012557	MF-108
DOE/PC/79892–					
T16	17:17741	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013373	MF-102
T18	17:17709	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013184	MF-102
T19	17:17710	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013353	MF-102
DOE/PC/79903–					
T11	17:17786	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011899	MF-105
T12	17:17787	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012263	PC-105
DOE/PC/79912–					
17	17:17742	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011274	MF-102
DOE/PC/79921–					
T11	17:17788	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009916	PC-106
DOE/PC/80016–					
T10	17:17743	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010947	PC-108
DOE/PC/88654–					
T4	17:17816	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011580	MF-102
T5	17:17817	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012642	MF-102
DOE/PC/88814–					
T7	17:17744	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009473	PC-108
DOE/PC/88851–					
T1	17:17789	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010988	PC-105
DOE/PC/88852–					
T5	17:17790	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009616	PC-105; PC-114

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DOE/PC/88891–					
T8	17:17745	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012262	PC-102
DOE/PC/88915–					
T13	17:17746	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011621	MF-109
DOE/PC/88930–					
T11	17:17747	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011895	MF-108
T12	17:17748	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011896	MF-108
DOE/PC/88934–					
T11	17:17711	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011276	PC-102
DOE/PC/88935–					
T10	17:17749	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011934	MF-108
DOE/PC/89659–					
T8	17:17818	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012554	MF-104
DOE/PC/89773–					
7	17:17750	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011909	MF-104
DOE/PC/89774–					
T3	17:17819	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011581	MF-104
DOE/PC/89781–					
9	17:17751	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012689	MF-102
DOE/PC/89783–					
T4	17:17752	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011459	MF-108
DOE/PC/89789–					
T4	17:17712	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012561	MF-113
DOE/PC/89807–					
T7	17:17791	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012660	MF-106
DOE/PC/89870–					
T1-Suppl.	17:17753	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011812	PC-108
DOE/PC/89883–					
37	17:17754	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009574	PC-108
DOE/PC/90005–					
T57	17:17755	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012435	PC-108
DOE/PC/90056–					
T1	17:17756	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013028	MF-108
T2	17:17757	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013029	MF-108
DOE/PC/90185–					
T4	17:17807	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012645	MF-117
DOE/PC/90274–					
T12	17:18675	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012687	MF-112
T13	17:18676	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012688	MF-112
DOE/PC/90292–					
T4	17:17792	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011622	MF-105
DOE/PC/90293–					
T3	17:17758	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010451	MF-113
DOE/PC/90294–					
T1	17:17759	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012640	MF-113
DOE/PC/90296–					
T5	17:17760	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012552	MF-102
DOE/PC/90298–					
T6	17:17761	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012646	MF-113
DOE/PC/90300–					
T5	17:17762	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011627	MF-113
DOE/PC/90303–					
T1	17:19473	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011416	MF-102
T2	17:19474	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011417	MF-102
DOE/PC/90305–					
T5	17:17763	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011626	MF-113
DOE/PC/90307–					
5	17:17764	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011910	MF-109
DOE/PC/90313–					
T3	17:17765	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011897	MF-108
T4	17:17766	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011898	MF-108
T5	17:17767	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012558	MF-108
DOE/PC/90361–					
T5	17:17793	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012639	MF-105
DOE/PC/90363–					
T3	17:17794	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011620	MF-105
DOE/PC/90365–					
T4	17:17795	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010989	PC-105
DOE/PC/90542–					
T4	17:17796	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012644	MF-105

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DOE/PC/90545–					
T4	17:17820	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009768	PC-105
DOE/PC/90548–					
T4	17:17797	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012560	MF-105
DOE/PC/91159–					
T1	17:17798	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013027	MF-105
DOE/PC/91288–					
T1	17:17768	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012505	MF-109
DOE/PC/91291–					
T1	17:17769	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011303	MF-108
DOE/PC/91297–					
T1	17:17808	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012553	MF-113
DOE/PC/91305–					
1	17:17775	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013026	MF-102
DOE/PC/91310–					
T1	17:17713	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010837	MF-113
DOE/PC/91337–					
T1	17:17799	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011409	MF-105
DOE/RL–					
90-08-DraftC	17:17953	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012251	MF-630
91-39	17:17954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012592	MF-630; MF-721
91-49	17:20506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012163	MF-902
91-54	17:17955	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013163	PC-812
91/09	17:20505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012593	MF-902
92-2	17:17956	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012162	MF-510
92-03	17:19475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012309	MF-702
92-25	17:17957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012204	MF-630
DOE/RW–					
0253-Rev.2	17:17960	OSTI (Free of Charge)		TI92012386	MF-800
0293P	17:17961	OSTI (Free of Charge); INIS		TI92013440	MF-800
0313P	17:17962	OSTI (Free of Charge)		TI92012388	MF-814
DOE/SA–					
0006	17:20559	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92013694	MF-900
DOE/SF/17712–					
T2	17:18260	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013525	MF-310
DOE/SF/17960–					
T12	17:18694	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011331	MF-350
DOE/SF/18852–					
T13	17:18678	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012302	MF-528
DOE/SSDC–					
76-45/4-Rev.3	17:20507	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013785	MF-600
DP-MS–					
89-1292	17:19083	OSTI; NTIS; GPO Dep.	E 1.99:	DE90017796	MF-502
DPSP–					
57-1340	17:18395	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011351	MF-701
58-1918	17:18396	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92010942	MF-701
59-391	17:18397	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011348	MF-904
60-1816	17:18398	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011346	MF-701
63-1192	17:18364	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011350	MF-700
66-1367	17:18399	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92010941	MF-701
DPST–					
70-548	17:17963	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013120	MF-721
72-210	17:19476	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013213	MF-702
74-533	17:18110	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92013094	MF-702
76-221	17:19477	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013220	MF-702
82-648	17:17964	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010677	MF-721
83-276	17:17896	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011120	MF-701
83-325	17:17965	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013073	MF-702
84-343	17:17966	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013387	MF-702
85-711	17:17967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013015	MF-702
85-783	17:18097	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013214	MF-702
85-861	17:17968	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013147	MF-701
86-735	17:17969	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013087	MF-701
87-596	17:17970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013088	MF-701
87-820	17:19478	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013190	MF-702
DPSTD–					
87-2-TL	17:17971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013146	MF-702
DTH-LV–					
91-21	17:18251	OSTI; NTIS (US Sales Only)		DE92506375	

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DTH-LV-MEDD–					
192	17:18695	OSTI; NTIS (US Sales Only)		DE92506374	
219	17:18252	OSTI; NTIS (US Sales Only)		DE92506376	
EGD-CERCLA–					
001/-0590	17:20508	OSTI (Free of Charge)		TI92012582	MF-630
EGG–					
10617-2127	17:17972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011449	MF-814
10617-2130	17:19567	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010485	MF-630
10617-3008	17:19278	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011448	MF-706
10617-4129	17:19444	*See* UCRL-JC–109830			
10617-6085	17:20560	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011146	MF-705
2608-Vol.2	17:18543	*See* NUREG/CR–5604-Vol.2			
2671	17:18547	*See* NUREG/CR–5855			
EGG-EP–					
9918	17:18742	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012317	MF-311
EGG-ESQ–					
10167	17:19479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013103	MF-902
EGG-FSP–					
10017	17:20443	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012312	MF-420
10048	17:20444	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012509	MF-420
9865	17:20441	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012221	MF-425
9977	17:20442	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012531	MF-406
EGG-GEO–					
10068	17:17973	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012320	MF-902
10158	17:17974	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012532	MF-902
9987	17:19480	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011699	MF-903
9990	17:19481	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012237	MF-903
EGG-HFRU–					
10026	17:20561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012358	
EGG-M–					
91135	17:18831	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011140	MF-400
91372	17:18420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011141	
91517	17:18344	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011152	MF-707
91551	17:18743	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011157	MF-310
EGG-ME–					
9968	17:19078	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012217	MF-506
EGG-MS–					
9879	17:17975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010488	MF-900
EGG-NE–					
10046	17:18295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012219	
10078	17:18421	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012311	MF-520
10083	17:18422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012321	MF-520
10137	17:20562	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012361	MF-405; MF-505
9768	17:19084	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012323	MF-513
EGG-PHY–					
10134	17:19360	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012366	MF-700
9978	17:18727	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012370	MF-500
EGG-PRP–					
10024	17:18423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012313	MF-406
EGG-SSRE–					
9625	17:18424	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012362	MF-610
9639	17:18291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012357	MF-507
EGG-WM–					
10109	17:17977	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012369	MF-900
9035-Rev.1	17:17976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012322	MF-902
9657	17:19482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012374	MF-940
EGG-WTD–					
10033	17:17999	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012368	MF-900
10035	17:18000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012522	MF-906; MF-902
10036	17:18001	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012512	MF-902
10056	17:18002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012510	MF-902
10080	17:19484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012528	MF-902
10081	17:18003	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012367	MF-900
10129	17:18004	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012373	MF-906
10180	17:19485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013101	MF-902; MF-906
9214	17:17978	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013100	MF-905
9432-Vol.1-Rev.1	17:17979	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012568	MF-903
9432-Vol.2	17:17980	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012569	MF-903

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9432-Vol.3	17:17981	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012601	MF-903
9520	17:17982	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012515	MF-902
9594-Vol.3	17:17983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012533	MF-902
9594-Vol.5	17:17984	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012534	MF-902
9594-Vol.6	17:17985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012535	MF-902
9594-Vol.7	17:17986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012536	MF-902
9594-Vol.8	17:17987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012537	MF-902
9752	17:17988	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012224	MF-902
9800	17:17989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012524	MF-902
9845	17:20292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012215	MF-906
9868	17:17990	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012310	MF-902
9872	17:17991	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012526	MF-902
9901	17:17992	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012371	MF-902
9911	17:17993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012365	MF-940
9923	17:17994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012523	MF-902
9925	17:17995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012372	MF-940
9980	17:19483	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012216	MF-902
9985-Vol.1	17:17996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012513	MF-902
9985-Vol.2	17:17997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012514	MF-902
9993	17:17998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012359	MF-902
EMO–					
1045	17:19486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012140	
ENEA-RT-INN–					
90-12	17:18989	OSTI; NTIS (US Sales Only); INIS		DE92506290	
90-24	17:19042	OSTI; NTIS (US Sales Only); INIS		DE92506291	
90-31	17:20563	OSTI; NTIS (US Sales Only)		DE92506269	
90-34	17:20564	OSTI; NTIS (US Sales Only)		DE92506266	
90-35	17:20445	OSTI; NTIS (US Sales Only)		DE92506265	
90-41	17:18832	OSTI; NTIS (US Sales Only); INIS		DE92506289	
90-43	17:19131	OSTI; NTIS (US Sales Only)		DE92506268	
ENEA-RT-NUCL–					
90-38	17:19345	OSTI; NTIS (US Sales Only); INIS		DE92506288	
ENEA-RTI-DS–					
91-03	17:18600	OSTI; NTIS (US Sales Only)		DE92506221	
ENEA-RTI-INN-SVIL–					
91-22	17:18807	OSTI; NTIS (US Sales Only)		DE92506235	
ENEA-RTI-NUC-IMP–					
91-02	17:19085	OSTI; NTIS (US Sales Only); INIS		DE92506283	
ENEA-RTI-STUDI-ENE–					
91-03	17:18744	OSTI; NTIS (US Sales Only)		DE92506234	
ENET–					
8900006/1	17:18159	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515358	
8900016-1	17:18745	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515357	
8900200/1	17:18229	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515344	
8900296/1	17:18246	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515345	
8900459/1	17:18234	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515361	
8900564/1	17:18696	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515355	
8900653-2	17:18160	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515347	
8990007/1	17:18247	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515356	
8990020/2	17:18697	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515351	
8990021/2	17:18728	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515346	
9100228/1	17:18788	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515359	
9100283/1	17:17876	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515354	
9100290/1	17:18235	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515363	
9100290/2	17:18236	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515364	
9100306/3	17:18698	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92515360	

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EPA–					
520/5-91-004	17:19487	OSTI; INIS; US Environmental Protection Agency, Office of Radiation Programs, 401 M. Street, S.W., Washington, DC 20460		TI92011254	
ER-B–					
92-04	17:20509	OSTI (Free of Charge)		TI92011915	PC-960
92-05	17:20510	OSTI (Free of Charge)		TI92011914	PC-960
92-06	17:20511	OSTI (Free of Charge)		TI92011852	PC-960
ESD–					
3746	17:19436	*See* ORNL/CDIAC–46			
ESH-EMS–					
890043	17:19490	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013085	MF-702
890044	17:19491	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013084	MF-702
890045	17:19492	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013082	MF-702
890046	17:19493	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013267	MF-702
90-0131	17:19488	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012662	MF-702
90-0132	17:19489	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013124	MF-702
900133	17:19494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012661	MF-702
900134	17:19495	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011908	MF-702
910088	17:19496	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013263	MF-702
ESL–					
91023-TR	17:18257	*See* DOE/ER/14083–1			
ESM–					
33	17:20279	OSTI; NTIS (US Sales Only); INIS		DE92627428	
35	17:20210	OSTI; NTIS (US Sales Only); INIS		DE92627368	
ETDE-IT–					
92-19	17:18990	OSTI; NTIS (US Sales Only)		DE92506220	
92-20	17:20370	OSTI; NTIS (US Sales Only); INIS		DE92506284	
92-21	17:18833	OSTI; NTIS (US Sales Only)		DE92506238	
92-22	17:18699	OSTI; NTIS (US Sales Only)		DE92506239	
92-23	17:19939	OSTI; NTIS (US Sales Only)		DE92506240	
92-24	17:19968	OSTI; NTIS (US Sales Only); INIS		DE92506286	
92-25	17:18834	OSTI; NTIS (US Sales Only)		DE92506241	
92-26	17:18579	OSTI; NTIS (US Sales Only)		DE92506242	
92-27	17:19351	OSTI; NTIS (US Sales Only)		DE92506243	
92-28	17:19352	OSTI; NTIS (US Sales Only)		DE92506244	
92-29	17:18578	OSTI; NTIS (US Sales Only); INIS		DE92506245	
92-30	17:20371	OSTI; NTIS (US Sales Only)		DE92506246	
92-31	17:20372	OSTI; NTIS (US Sales Only)		DE92506247	
92-32	17:18584	OSTI; NTIS (US Sales Only)		DE92506259	
92-33	17:18580	OSTI; NTIS (US Sales Only)		DE92506260	
92-34	17:18275	OSTI; NTIS (US Sales Only)		DE92506261	
92-35	17:18583	OSTI; NTIS (US Sales Only)		DE92506262	
92-36	17:19086	OSTI; NTIS (US Sales Only); INIS		DE92506287	
92-37	17:18581	OSTI; NTIS (US Sales Only)		DE92506263	
92-38	17:20565	OSTI; NTIS (US Sales Only)		DE92506264	
ETDE-mf–					
92506987	17:18700	OSTI; NTIS (US Sales Only)		DE92506987	
92515847	17:18746	OSTI; NTIS (US Sales Only)		DE92515847	
92516652	17:19934	OSTI; NTIS (US Sales Only)		DE92516652	
92516820	17:19935	OSTI; NTIS (US Sales Only)		DE92516820	
ETH-TH–					
91/43	17:20072	*See* DESY–91-140			
EUR–					
12503(v.1)	17:19497	OSTI; NTIS (US Sales Only)		TI92767107	
12503(v.2)	17:19498	OSTI; NTIS (US Sales Only)		TI92767108	
12503(v.3)	17:19499	OSTI; NTIS (US Sales Only)		TI92767110	
12503(v.4)	17:19405	OSTI; NTIS (US Sales Only)		TI92767109	
FE-MIT–					
89773-7	17:17750	*See* DOE/PC/89773–7			
FEI–					
2167	17:18961	OSTI; NTIS (US Sales Only); INIS		DE92625763	
FEMP–					
2260	17:18005	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011391	MF-702; MF-721
2262	17:18006	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011392	MF-702; MF-721
2264	17:18007	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011148	MF-721
FNAL-TM–					
1768	17:19205	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011703	PC-414
1770	17:19281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013594	PC-414

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1773	17:20566	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011704	PC-405
FNAL/C–					
91/307	17:19204	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011759	MF-406; MF-414
91/335-A	17:20023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011701	MF-414
91/349-A	17:20024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011734	MF-414
92/20-A	17:20025	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011736	MF-414
92/26A	17:20141	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011735	MF-414
92/62	17:20142	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011281	MF-414
92/63	17:19279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010650	MF-414
92/65	17:20082	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011094	MF-414
92/66	17:19280	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011279	MF-406
92/79	17:19994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011378	MF-414
FRCEA-TH–					
353	17:20373	OSTI; NTIS (US Sales Only); INIS		DE92517880	
FTUV–					
91-52	17:20023	*See* FNAL/C–91/335-A			
92-5	17:20079	*See* DESY–92-009			
G/C–					
2787-1	17:17789	*See* DOE/PC/88851–T1			
GA-A–					
20849	17:20374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011393	MF-426
20855	17:20375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013008	MF-420
20860	17:20446	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011394	MF-426
20876	17:20376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012699	MF-420
GD/PE-N–					
729	17:18303	*See* NUREG/IA–0056			
GEO-EIS–					
86	17:19500	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013128	MF-702
GKSS–					
90/E/13	17:19406	OSTI; NTIS (US Sales Only)		DE92516553	
91/E/65	17:19282	OSTI; NTIS (US Sales Only); INIS		DE92516930	
91/E/82	17:19283	OSTI; NTIS (US Sales Only); INIS		DE92516929	
GSF–					
30/91	17:19874	OSTI; NTIS (US Sales Only); INIS		DE92511441	
32/91	17:18008	OSTI; NTIS (US Sales Only); INIS		DE92516785	
GSF-HY–					
1/91	17:19501	OSTI; NTIS (US Sales Only); INIS		DE92511426	
GSF-TL–					
24/91	17:18008	*See* GSF–32/91			
GSI–					
91-37	17:19255	OSTI; NTIS (US Sales Only)		DE92785038	
91-63(prepr.)	17:19206	OSTI; NTIS (US Sales Only); INIS		DE92516496	
91-64(prepr.)	17:20206	OSTI; NTIS (US Sales Only); INIS		DE92516494	
91-65(prepr.)	17:19995	OSTI; NTIS (US Sales Only); INIS		DE92516489	
91-67(prepr.)	17:20280	OSTI; NTIS (US Sales Only); INIS		DE92516498	
91-68(prepr.)	17:20211	OSTI; NTIS (US Sales Only); INIS		DE92516491	
92-02(prepr.)	17:20212	OSTI; NTIS (US Sales Only); INIS		DE92516782	
92-03(prepr.)	17:20265	OSTI; NTIS (US Sales Only); INIS		DE92516789	
92-04	17:20199	OSTI; NTIS (US Sales Only); INIS		DE92517028	
92-05	17:19284	OSTI; NTIS (US Sales Only); INIS		DE92517027	
92-06(prepr.)	17:20213	OSTI; NTIS (US Sales Only); INIS		DE92517001	
92-07(prepr.)	17:20214	OSTI; NTIS (US Sales Only); INIS		DE92517003	
92-08(prepr.)	17:20215	OSTI; NTIS (US Sales Only); INIS		DE92517000	
HAN–					
17226	17:19506	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011857	MF-700
26626	17:17898	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011858	MF-707
29064	17:18013	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011859	MF-721
4113	17:18098	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011860	MF-707
41693	17:18014	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011861	MF-707
48422	17:18219	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011314	MF-402
HEPHY-PUB–					
550-91	17:20083	OSTI; NTIS (US Sales Only); INIS		DE92628519	
561-91.	17:20136	*See* UWThPh–1991-44			
562-91	17:20026	OSTI; NTIS (US Sales Only); INIS		DE92628500	
563-91	17:20027	OSTI; NTIS (US Sales Only); INIS		DE92627263	
566-91	17:20084	OSTI; NTIS (US Sales Only); INIS		DE92628511	
HIFAN–					
536	17:20452	*See* LBL–31943			
HLRZ–					
97/91	17:19989	*See* DESY–91-152			

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HMI-B–					
493	17:20302	OSTI; NTIS (US Sales Only); INIS		DE92517034	
HPR–					
87-002	17:19507	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013081	MF-702
87-158	17:19508	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013077	MF-702
88-098	17:19509	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013086	MF-702
88-238	17:19510	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013389	MF-702
88-300	17:19511	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013388	MF-702
88-489	17:19512	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013141	MF-702
HW–					
11715	17:18400	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92012291	MF-520
13467	17:19875	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92010884	MF-502
17986-RD	17:17899	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011862	MF-700
29230	17:17900	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011864	MF-702
32808	17:18099	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011863	MF-702
HWS–					
8584	17:18747	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011855	MF-406
IBP-FB–					
32/1991	17:18701	OSTI; NTIS (US Sales Only)		DE92516783	
IEE-SR–					
224	17:17857	OSTI; NTIS (US Sales Only)		DE92514558	
225	17:18622	OSTI; NTIS (US Sales Only)		DE92514557	
IFE/KR/E–					
92/001	17:18264	OSTI; NTIS (US Sales Only)		DE92506558	
92/002	17:19409	OSTI; NTIS (US Sales Only); INIS		DE92627916	
IFIC–					
92-5	17:20079	*See* DESY–92-009			
IFSR–					
530	17:20368	*See* DOE/ET/53088–530			
541	17:20369	*See* DOE/ET/53088–541			
IFVE–					
91-80	17:19256	OSTI; NTIS (US Sales Only); INIS		DE92626839	
IFVE-OEF–					
91-41	17:20085	OSTI; NTIS (US Sales Only); INIS		DE92627299	
91-49	17:20086	OSTI; NTIS (US Sales Only); INIS		DE92627300	
IFVE-ONF–					
91-128	17:20087	OSTI; NTIS (US Sales Only); INIS		DE92627301	
91-139	17:20143	OSTI; NTIS (US Sales Only); INIS		DE92627317	
91-165	17:20088	OSTI; NTIS (US Sales Only); INIS		DE92627296	
IFVE-OTF–					
91-39	17:20028	OSTI; NTIS (US Sales Only); INIS		DE92627282	
IG–					
91/01	17:19557	OSTI; NTIS (US Sales Only); INIS		DE92625829	
IHEP-OEF–					
91-11	17:20144	OSTI; NTIS (US Sales Only); INIS		DE92627320	
91-149	17:19257	OSTI; NTIS (US Sales Only); INIS		DE92626840	
IHEP-OEIUNK–					
91-95	17:20089	OSTI; NTIS (US Sales Only); INIS		DE92627308	
IHEP-ONF–					
91-74	17:20090	OSTI; NTIS (US Sales Only); INIS		DE92627288	
91-79	17:20091	OSTI; NTIS (US Sales Only); INIS		DE92627297	
IHEP-OTF–					
91-117	17:20092	OSTI; NTIS (US Sales Only); INIS		DE92627289	
91-148	17:20093	OSTI; NTIS (US Sales Only); INIS		DE92627290	
91-163	17:20094	OSTI; NTIS (US Sales Only); INIS		DE92627302	
91-39.	17:20028	*See* IFVE-OTF–91-39			
91-91	17:20029	OSTI; NTIS (US Sales Only); INIS		DE92627272	
IIEC–					
92011741	17:20622	OSTI; International Institute for Energy Conservation, 420 C Street, N.E., Washington, DC 20002		TI92011741	
ILWRP–					
85-P12.	17:17959	*See* DOE-RW–90.092			
85-P13.	17:17942	*See* DOE-HMIP-RR–91.013			
86-P01.	17:17958	*See* DOE-RW–90.089			
86-P02.	17:17941	*See* DOE-HMIP-RR–91.012			
INDC(FR)–					
071/L	17:20195	*See* NEANDC(E)–246/L			
INEL/MISC–					
91107	17:18015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012222	MF-902
92032	17:19026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012218	MF-902

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INFN-AE–					
90-15	17:20095	OSTI; NTIS (US Sales Only); INIS		DE92627291	
91-09	17:20096	OSTI; NTIS (US Sales Only); INIS		DE92627292	
91-12	17:20097	OSTI; NTIS (US Sales Only); INIS		DE92627309	
91-15	17:20098	OSTI; NTIS (US Sales Only); INIS		DE92627310	
INFN-BE–					
91-05	17:20099	OSTI; NTIS (US Sales Only); INIS		DE92627293	
INFN-LNF–					
90-019(R)	17:19258	OSTI; NTIS (US Sales Only); INIS		DE92626841	
91-031(R)	17:19259	OSTI; NTIS (US Sales Only); INIS		DE92626842	
91-061(R)	17:19285	OSTI; NTIS (US Sales Only); INIS		DE92626995	
91-062(R)	17:19286	OSTI; NTIS (US Sales Only); INIS		DE92626996	
INFN-TC–					
91-05	17:19287	OSTI; NTIS (US Sales Only); INIS		DE92626979	
91-07	17:19207	OSTI; NTIS (US Sales Only); INIS		DE92626819	
91-08	17:19260	OSTI; NTIS (US Sales Only); INIS		DE92628179	
91-10	17:20447	OSTI; NTIS (US Sales Only); INIS		DE92627507	
INFO–					
0102-5	17:18124	OSTI; NTIS (US Sales Only); INIS		DE92626780	
0206	17:18623	OSTI; NTIS (US Sales Only); INIS		DE92627088	
0206(add.)	17:19877	OSTI; NTIS (US Sales Only); INIS		DE92628369	
0207	17:18640	OSTI; NTIS (US Sales Only); INIS		DE92627089	
0208	17:18016	OSTI; NTIS (US Sales Only); INIS		DE92628325	
0209	17:18320	OSTI; NTIS (US Sales Only); INIS		DE92626945	
0210	17:18385	OSTI; NTIS (US Sales Only); INIS		DE92626946	
0211	17:18991	OSTI; NTIS (US Sales Only); INIS		DE92625302	
0212	17:18641	OSTI; NTIS (US Sales Only); INIS		DE92628370	
0213	17:20630	OSTI; NTIS (US Sales Only); INIS		DE92628393	
0281	17:18125	OSTI; NTIS (US Sales Only); INIS		DE92626790	
0337	17:18365	OSTI; NTIS (US Sales Only); INIS		DE92628186	
0359	17:18642	OSTI; NTIS (US Sales Only); INIS		DE92627090	
INIS-BR–					
2922	17:19582	OSTI; NTIS (US Sales Only); INIS		DE92626267	
INIS-GB–					
428	17:19806	OSTI; NTIS (US Sales Only); INIS		DE92628097	
433	17:19513	OSTI; NTIS (US Sales Only); INIS		DE92627847	
434	17:18017	OSTI; NTIS (US Sales Only); INIS		DE92627848	
435	17:19410	OSTI; NTIS (US Sales Only); INIS		DE92628023	
439	17:20512	OSTI; NTIS (US Sales Only); INIS		DE92628415	
INIS-SU–					
307	17:18356	OSTI; NTIS (US Sales Only); INIS		DE92001354	
309/A	17:18862	OSTI; NTIS (US Sales Only); INIS		DE92001357	
312	17:20167	OSTI; NTIS (US Sales Only); INIS		DE92001360	
313	17:19901	OSTI; NTIS (US Sales Only); INIS		DE92001358	
INIS-mf–					
13146	17:17894	OSTI; NTIS (US Sales Only); INIS		DE92625523	
13150	17:18121	OSTI; NTIS (US Sales Only); INIS		DE92627124	
13151	17:18018	OSTI; NTIS (US Sales Only); INIS		DE92627041	
13154	17:20623	OSTI; NTIS (US Sales Only); INIS		DE92628395	
13159	17:18835	OSTI; NTIS (US Sales Only); INIS		DE92625598	
13164	17:18816	OSTI; NTIS (US Sales Only); INIS		DE92627130	
13165	17:18811	OSTI; NTIS (US Sales Only); INIS		DE92627131	
13166	17:18812	OSTI; NTIS (US Sales Only); INIS		DE92627132	
13167	17:18813	OSTI; NTIS (US Sales Only); INIS		DE92627133	
13168	17:18814	OSTI; NTIS (US Sales Only); INIS		DE92627134	
13169	17:18188	OSTI; NTIS (US Sales Only); INIS		DE92627114	
13170	17:18189	OSTI; NTIS (US Sales Only); INIS		DE92627115	
13171	17:18190	OSTI; NTIS (US Sales Only); INIS		DE92627116	
13172	17:18191	OSTI; NTIS (US Sales Only); INIS		DE92627117	
13173	17:18192	OSTI; NTIS (US Sales Only); INIS		DE92627118	
13174	17:18193	OSTI; NTIS (US Sales Only); INIS		DE92627119	
13175	17:18194	OSTI; NTIS (US Sales Only); INIS		DE92627120	
13176	17:18195	OSTI; NTIS (US Sales Only); INIS		DE92627121	
13177	17:18208	OSTI; NTIS (US Sales Only); INIS		DE92626263	
13178	17:20293	OSTI; NTIS (US Sales Only); INIS		DE92001361	
13179	17:20166	OSTI; NTIS (US Sales Only); INIS		DE92001359	
13180	17:20513	OSTI; NTIS (US Sales Only); INIS		DE92627154	
13181	17:20514	OSTI; NTIS (US Sales Only); INIS		DE92627155	
13182	17:19879	OSTI; NTIS (US Sales Only); INIS		DE92626023	
13183	17:19807	OSTI; NTIS (US Sales Only); INIS		DE92626268	
13185	17:18348	OSTI; NTIS (US Sales Only); INIS		DE92627091	

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13186	17:18321	OSTI; NTIS (US Sales Only); INIS		DE92628220	
13187	17:18643	OSTI; NTIS (US Sales Only); INIS		DE92627092	
13188	17:18100	OSTI; NTIS (US Sales Only); INIS		DE92626187	
13190	17:20631	OSTI; NTIS (US Sales Only); INIS		DE92628386	
13193	17:18287	OSTI; NTIS (US Sales Only); INIS		DE92628191	
13196	17:19816	OSTI; NTIS (US Sales Only); INIS		DE92628099	
14056	17:18932	OSTI; NTIS (US Sales Only); INIS		DE92516856	
INS–					
905	17:19208	OSTI; NTIS (US Sales Only); INIS		DE92514955	
906	17:19209	OSTI; NTIS (US Sales Only); INIS		DE92514956	
907	17:19210	OSTI; NTIS (US Sales Only); INIS		DE92514957	
912	17:20007	OSTI; NTIS (US Sales Only); INIS		DE92514985	
913	17:20186	OSTI; NTIS (US Sales Only); INIS		DE92514986	
914	17:20187	OSTI; NTIS (US Sales Only); INIS		DE92515032	
INS-T–					
505	17:19165	OSTI; NTIS (US Sales Only); INIS		DE92514941	
IPP–					
2/313	17:20448	OSTI; NTIS (US Sales Only); INIS		DE92517002	
5/37	17:20383	OSTI; NTIS (US Sales Only); INIS		DE92516984	
6/304	17:20384	OSTI; NTIS (US Sales Only); INIS		DE92516509	
IS-M–					
683	17:18879	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012155	MF-404
686	17:19009	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012156	MF-406
700	17:18880	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010871	MF-404
IS-T–					
1555	17:18748	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012585	MF-406
1570	17:18939	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012584	MF-406
1580	17:20346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012587	MF-411
1586	17:20111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012583	MF-414
1592	17:17714	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012586	MF-404
1612	17:18881	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012550	MF-401
ISN–					
91-55	17:19318	OSTI; NTIS (US Sales Only); INIS		DE92517865	
ITER/US–					
91/EN-ME-1	17:20483	*See* UCRL-CR–109602			
ITF–					
89-43	17:20008	OSTI; NTIS (US Sales Only); INIS		DE92627217	
89-44	17:19963	OSTI; NTIS (US Sales Only); INIS		DE92627159	
89-45	17:20009	OSTI; NTIS (US Sales Only); INIS		DE92627218	
89-46	17:20112	OSTI; NTIS (US Sales Only); INIS		DE92627303	
89-58	17:20385	OSTI; NTIS (US Sales Only); INIS		DE92627439	
89-82	17:20386	OSTI; NTIS (US Sales Only); INIS		DE92627455	
90-7	17:20241	OSTI; NTIS (US Sales Only); INIS		DE92627379	
90-16	17:20043	OSTI; NTIS (US Sales Only); INIS		DE92627275	
90-54	17:20347	OSTI; NTIS (US Sales Only); INIS		DE92627559	
ITP–					
89-28	17:20348	OSTI; NTIS (US Sales Only); INIS		DE92627560	
89-32	17:20387	OSTI; NTIS (US Sales Only); INIS		DE92627456	
89-36	17:20242	OSTI; NTIS (US Sales Only); INIS		DE92627380	
89-37	17:20388	OSTI; NTIS (US Sales Only); INIS		DE92627457	
89-38	17:20389	OSTI; NTIS (US Sales Only); INIS		DE92627458	
89-42	17:20010	OSTI; NTIS (US Sales Only); INIS		DE92627219	
89-43	17:19964	OSTI; NTIS (US Sales Only); INIS		DE92627160	
89-45	17:20044	OSTI; NTIS (US Sales Only); INIS		DE92627269	
89-55	17:20045	OSTI; NTIS (US Sales Only); INIS		DE92627276	
89-56	17:20158	OSTI; NTIS (US Sales Only); INIS		DE92627321	
89-57	17:20011	OSTI; NTIS (US Sales Only); INIS		DE92627259	
89-58	17:20012	OSTI; NTIS (US Sales Only); INIS		DE92627215	
89-59	17:20390	OSTI; NTIS (US Sales Only); INIS		DE92627459	
89-60	17:20391	OSTI; NTIS (US Sales Only); INIS		DE92627460	
89-62	17:20188	OSTI; NTIS (US Sales Only); INIS		DE92627350	
89-63	17:20189	OSTI; NTIS (US Sales Only); INIS		DE92627351	
89-66	17:20392	OSTI; NTIS (US Sales Only); INIS		DE92627461	
89-72	17:20046	OSTI; NTIS (US Sales Only); INIS		DE92627277	
89-73	17:20047	OSTI; NTIS (US Sales Only); INIS		DE92627278	
89-76	17:20113	OSTI; NTIS (US Sales Only); INIS		DE92627304	
89-79	17:20190	OSTI; NTIS (US Sales Only); INIS		DE92627352	
89-81	17:20048	OSTI; NTIS (US Sales Only); INIS		DE92627270	
89-82	17:20013	OSTI; NTIS (US Sales Only); INIS		DE92627220	
89-83	17:20049	OSTI; NTIS (US Sales Only); INIS		DE92627264	
90-5	17:20014	OSTI; NTIS (US Sales Only); INIS		DE92627223	

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90-16	17:20015	OSTI; NTIS (US Sales Only); INIS		DE92627221	
90-21	17:20050	OSTI; NTIS (US Sales Only); INIS		DE92627279	
90-34	17:20159	OSTI; NTIS (US Sales Only); INIS		DE92627322	
90-42	17:20114	OSTI; NTIS (US Sales Only); INIS		DE92627305	
90-44	17:20243	OSTI; NTIS (US Sales Only); INIS		DE92627389	
90-46	17:20016	OSTI; NTIS (US Sales Only); INIS		DE92627222	
90-51	17:20191	OSTI; NTIS (US Sales Only); INIS		DE92627353	
90-78	17:20160	OSTI; NTIS (US Sales Only); INIS		DE92627323	
90-84	17:20051	OSTI; NTIS (US Sales Only); INIS		DE92627271	
91-11	17:20052	OSTI; NTIS (US Sales Only); INIS		DE92627283	
91-25	17:20393	OSTI; NTIS (US Sales Only); INIS		DE92627497	
ITP-SB–					
91-34	17:20194	*See* LBL–31382			
ITPR–					
91018	17:19514	OSTI; NTIS (US Sales Only); INIS		DE92626180	
IVL-B–					
1044	17:19515	OSTI; NTIS (US Sales Only)		DE92506564	
IVO-B–					
10/91	17:18227	OSTI; NTIS (US Sales Only); INIS		DE92506512	
11/91	17:18276	OSTI; NTIS (US Sales Only)		DE92506511	
12/91	17:18280	OSTI; NTIS (US Sales Only)		DE92506513	
IYaF–					
91-19	17:19211	OSTI; NTIS (US Sales Only); INIS		DE92624158	
JAERI-M–					
91-205	17:20394	OSTI; NTIS (US Sales Only); INIS		DE92514959	
91-210	17:19516	OSTI; NTIS (US Sales Only); INIS		DE92514960	
91-220	17:18301	OSTI; NTIS (US Sales Only); INIS		DE92514972	
91-227	17:18425	OSTI; NTIS (US Sales Only); INIS		DE92514981	
92-001	17:18426	OSTI; NTIS (US Sales Only); INIS		DE92514982	
92-012	17:18288	OSTI; NTIS (US Sales Only); INIS		DE92514925	
JET-R–					
91-10	17:20395	OSTI; NTIS (US Sales Only); INIS		DE92628700	
91-12	17:20396	OSTI; NTIS (US Sales Only); INIS		DE92628699	
91-14	17:20397	OSTI; NTIS (US Sales Only); INIS		DE92628701	
JINR–					
13-90-63	17:19216	OSTI; NTIS (US Sales Only); INIS		DE92628169	
9-90-107	17:19214	OSTI; NTIS (US Sales Only); INIS		DE92626820	
9-90-114	17:19215	OSTI; NTIS (US Sales Only); INIS		DE92626830	
9-90-152	17:19166	OSTI; NTIS (US Sales Only); INIS		DE92626808	
9-90-64	17:19212	OSTI; NTIS (US Sales Only); INIS		DE92626817	
9-90-69	17:19213	OSTI; NTIS (US Sales Only); INIS		DE92626831	
JINR-D–					
9-89-52(v.2)	17:19156	OSTI; NTIS (US Sales Only); INIS		DE92001343	
JINR-E–					
9-90-92	17:19178	OSTI; NTIS (US Sales Only); INIS		DE92626813	
JINR-R–					
1-90-75	17:19217	OSTI; NTIS (US Sales Only); INIS		DE92628170	
9-90-65	17:19179	OSTI; NTIS (US Sales Only); INIS		DE92626814	
JSR–					
90-310	17:20294	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013601	MF-406
91-330A	17:19419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013602	MF-402
Juel–					
2481	17:18020	OSTI; NTIS (US Sales Only); INIS		DE92511180	
2512	17:19420	OSTI; NTIS (US Sales Only)		DE92511438	
2518	17:18161	OSTI; NTIS (US Sales Only)		DE92511498	
2523	17:18940	OSTI; NTIS (US Sales Only); INIS		DE92511502	
2535	17:18882	OSTI; NTIS (US Sales Only); INIS		DE92511505	
2536	17:18789	OSTI; NTIS (US Sales Only)		DE92506963	
2538	17:18427	OSTI; NTIS (US Sales Only); INIS		DE92511482	
2539	17:18428	OSTI; NTIS (US Sales Only); INIS		DE92511512	
2540	17:20244	OSTI; NTIS (US Sales Only); INIS		DE92511504	
2546	17:19517	OSTI; NTIS (US Sales Only); INIS		DE92516927	
2553	17:18624	OSTI; NTIS (US Sales Only)		DE92511586	
2560	17:18941	OSTI; NTIS (US Sales Only); INIS		DE92511439	
2564	17:18799	OSTI; NTIS (US Sales Only)		DE92511719	
K/ETO–					
96-Rev.1	17:20288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013383	MF-501
K/GDP/SAR–					
15	17:19518	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012314	MF-703
K/SS–					
546	17:17914	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011611	MF-515

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
KCP–					
613-4501	17:18883	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012111	PC-706
613-4502	17:18884	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012109	PC-706
613-4503	17:19087	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012116	PC-706
613-4504	17:18966	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012112	PC-706
613-4505	17:18749	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012108	PC-706
613-4547	17:19088	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012566	PC-706
613-4650	17:18942	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013158	PC-706
613-4661	17:18967	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013159	PC-706
613-4667	17:19132	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013705	PC-706
613-4742	17:20567	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011343	MF-705
613-4748	17:19133	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013704	PC-706
613-4837	17:18885	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011489	MF-706
613-4849	17:20515	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011342	MF-700
613-4854	17:20516	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011341	MF-700
KEK–					
91-9	17:19180	OSTI; NTIS (US Sales Only); INIS		DE92514987	
91-10	17:19218	OSTI; NTIS (US Sales Only); INIS		DE92514988	
KEK-PROC–					
91-9	17:20321	OSTI; NTIS (US Sales Only); INIS		DE92515058	
KFK–					
4794	17:18128	OSTI; NTIS (US Sales Only); INIS		DE92511580	
4873	17:20245	OSTI; NTIS (US Sales Only); INIS		DE92511423	
4905	17:18886	OSTI; NTIS (US Sales Only); INIS		DE92511507	
4909	17:18887	OSTI; NTIS (US Sales Only); INIS		DE92511179	
4929	17:20449	OSTI; NTIS (US Sales Only); INIS		DE92511178	
4940	17:18943	OSTI; NTIS (US Sales Only); INIS		DE92511506	
4945	17:18021	OSTI; NTIS (US Sales Only); INIS		DE92511440	
4946	17:20257	OSTI; NTIS (US Sales Only); INIS		DE92511581	
4948	17:19110	OSTI; NTIS (US Sales Only); INIS		DE92511593	
4949	17:19111	OSTI; NTIS (US Sales Only); INIS		DE92511592	
4956	17:20258	OSTI; NTIS (US Sales Only); INIS		DE92511582	
4958	17:20450	OSTI; NTIS (US Sales Only); INIS		DE92511417	
4960	17:20246	OSTI; NTIS (US Sales Only); INIS		DE92511424	
4969	17:18968	OSTI; NTIS (US Sales Only); INIS		DE92511574	
4972	17:18340	OSTI; NTIS (US Sales Only); INIS		DE92511594	
KINR–					
90-24	17:19167	OSTI; NTIS (US Sales Only); INIS		DE92626809	
KIYai–					
89-18	17:20568	OSTI; NTIS (US Sales Only); INIS		DE92627147	
89-22	17:19969	OSTI; NTIS (US Sales Only); INIS		DE92627209	
89-25	17:19965	OSTI; NTIS (US Sales Only); INIS		DE92627161	
89-30	17:19966	OSTI; NTIS (US Sales Only); INIS		DE92627162	
89-34	17:20322	OSTI; NTIS (US Sales Only); INIS		DE92627517	
90-12	17:20247	OSTI; NTIS (US Sales Only); INIS		DE92627399	
90-14	17:20569	OSTI; NTIS (US Sales Only); INIS		DE92627148	
90-16	17:20323	OSTI; NTIS (US Sales Only); INIS		DE92627518	
90-17	17:18888	OSTI; NTIS (US Sales Only); INIS		DE92625643	
90-21	17:20570	OSTI; NTIS (US Sales Only); INIS		DE92627149	
90-22	17:20398	OSTI; NTIS (US Sales Only); INIS		DE92627498	
90-32	17:18302	OSTI; NTIS (US Sales Only); INIS		DE92626908	
90-46	17:19421	OSTI; NTIS (US Sales Only); INIS		DE92626188	
KTM/E-B–					
99	17:18750	OSTI; NTIS (US Sales Only)		DE92506483	
KTM/E-D–					
198	17:18601	OSTI; NTIS (US Sales Only)		DE92506484	
KURRI-TR–					
356	17:19817	OSTI; NTIS (US Sales Only); INIS		DE92514983	
357	17:19818	OSTI; NTIS (US Sales Only); INIS		DE92514984	
LA–					
11978-MS	17:18022	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011491	MF-721
12197-MS	17:19382	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013553	PC-700; PC-900
12198-MS	17:20517	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012564	PC-900
12237-MS	17:19320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011758	MF-706
12240	17:18429	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012220	
12258	17:20259	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013108	MF-905
12262-T	17:20116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011451	MF-410
12271-MS	17:19422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011705	MF-902
12277-MS	17:19321	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010927	
12278-MS	17:18114	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011488	MF-700

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
12283-SR	17:17828	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013556	MF-122
12284-T	17:20295	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013056	MF-910
12293-MS	17:19381	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012400	PC-700
12294-MS	17:19383	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013554	PC-700
12298-MS	17:19384	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013555	PC-700
12299-MS	17:19385	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014176	PC-700
12301-MS	17:19519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011870	MF-940
12309-MS	17:18115	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012170	MF-700
LA-UR–					
91-209	17:18430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007319	MF-523
91-3097	17:18969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000177	MF-711
92-1004	17:19525	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011227	MF-402
92-104	17:19361	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007587	MF-905
92-1043	17:20402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011228	MF-426
92-1048	17:20573	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011229	MF-905
92-1086	17:18431	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011230	MF-940
92-1237	17:18258	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013544	MF-256
92-1370	17:18971	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013434	
92-1426	17:18945	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013385	MF-904
92-1435	17:18946	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013379	MF-904
92-296	17:19972	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007565	MF-906; MF-910
92-40	17:19035	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007424	MF-901
92-461	17:18023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008473	MF-814
92-653	17:20625	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011271	MF-900
92-659	17:18889	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008490	MF-904
92-667	17:18890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011270	MF-706
92-706	17:18944	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011357	MF-364
92-708	17:19520	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011356	
92-709	17:19521	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011355	
92-742	17:20192	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011354	MF-413
92-748	17:18970	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011353	MF-901; MF-904
92-751	17:20248	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011285	MF-413
92-754	17:19134	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011286	MF-906
92-756	17:19112	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011352	MF-906
92-759	17:19113	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011266	MF-910; MF-906
92-764	17:19323	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011267	MF-906
92-789	17:19353	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011359	MF-906
92-792	17:20333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011371	MF-706
92-805	17:20571	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011372	MF-405
92-826	17:20399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011262	MF-420
92-829	17:20572	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011263	MF-705
92-837	17:20400	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011264	MF-706; MF-705
92-845	17:19973	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011265	MF-910
92-861	17:19974	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011369	MF-700
92-869	17:18679	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011370	
92-875	17:20451	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011365	MF-712
92-879	17:19975	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011158	MF-700
92-883	17:18116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011269	MF-706
92-887	17:18891	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011138	MF-904
92-889	17:18815	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011268	MF-900
92-890	17:18638	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011360	MF-900
92-895	17:17829	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011361	MF-403
92-896	17:19135	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011362	MF-706
92-899	17:19219	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011235	MF-400
92-903	17:20401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011135	MF-424
92-905	17:19220	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011137	MF-910
92-922	17:20349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011133	MF-906
92-924	17:19522	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011236	MF-403
92-926	17:20168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011868	MF-410
92-936	17:19324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011237	MF-910
92-949	17:19423	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011134	MF-906
92-958	17:19118	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011231	MF-705; MF-704
92-971	17:19523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011232	MF-940
92-978	17:18255	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011234	MF-251
92-980	17:20193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011495	MF-910
92-984	17:18680	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011493	MF-920

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92-985	17:19524	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011496	
92-989	17:20334	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011226	MF-700
LAL-RT–					
90-06	17:19322	OSTI; NTIS (US Sales Only); INIS		DE92517870	
LBL–					
31194	17:19036	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011729	MF-401
31214	17:19424	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010295	MF-402
31243	17:19168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011728	MF-414
31382	17:20194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010475	MF-414
31398	17:19908	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010265	MF-408
31456	17:18947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010301	MF-406; MF-408
31457	17:19819	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011147	MF-408
31483	17:20053	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010259	MF-414
31590	17:19064	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010310	MF-406
31592	17:19577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010257	MF-408
31596	17:19325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011727	MF-413
31685	17:19909	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010256	MF-407
31943	17:20452	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013762	MF-415
32075	17:19229	*See* SLAC-PUB–5775			
LIS–					
97	17:19425	OSTI; NTIS (US Sales Only)		DE92516792	
LITH-MAT-R–					
92-02	17:18729	OSTI; NTIS (US Sales Only)		DE92506618	
LMF–					
134	17:19910	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012104	PC-402; PC-406; PC-408
LMU–					
91/05	17:20072	*See* DESY–91-140			
LNS–					
161	17:20324	OSTI; NTIS (US Sales Only); INIS		DE92627519	
LRAP–					
119	17:20275	OSTI; NTIS (US Sales Only); INIS		DE92624995	
LRP–					
439/91	17:20403	OSTI; NTIS (US Sales Only); INIS		DE92627440	
442/91	17:20404	OSTI; NTIS (US Sales Only); INIS		DE92627501	
444/91	17:20405	OSTI; NTIS (US Sales Only); INIS		DE92627449	
450/92	17:20406	OSTI; NTIS (US Sales Only); INIS		DE92627450	
451/92	17:20407	OSTI; NTIS (US Sales Only); INIS		DE92627451	
LUMEDW-MEKP–					
1019-1-104-1991	17:19820	OSTI; NTIS (US Sales Only); INIS		DE92628116	
LUMEDW-MEMR–					
1002	17:19911	OSTI; NTIS (US Sales Only); INIS		DE92626220	
LUNFD6-NFFA–					
1018-1-150-1991	17:20289	OSTI; NTIS (US Sales Only); INIS		DE92628694	
LUTFD2-TFRT–					
4019-1-71-1991	17:20518	OSTI; NTIS (US Sales Only); INIS		DE92628416	
LUTMDN-TMVK–					
3146-1-25-92	17:18587	OSTI; NTIS (US Sales Only)		DE92506573	
5208-1-74-91	17:18277	OSTI; NTIS (US Sales Only); INIS		DE92506565	
7009-1-76-92	17:18588	OSTI; NTIS (US Sales Only)		DE92506574	
M–					
276-Rev.1	17:20574	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011289	MF-700
MDRTE-CDM–					
27.	17:19015	*See* CDM–27			
MHD-ITC–					
91-021	17:18675	*See* DOE/PC/90274–T12			
92-019	17:18676	*See* DOE/PC/90274–T13			
MISC–					
90120	17:18419	*See* DOE/ID–10291			
MLM–					
3731	17:19377	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012413	PC-700
3735	17:18948	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012411	PC-701
3737	17:18972	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012412	PC-700
3738	17:19089	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011700	MF-706
MPI-Ph–					
91-107	17:20118	*See* PHE–91-09			
MPI-PhE–					
91-06	17:19326	OSTI; NTIS (US Sales Only); INIS		DE92516647	
91-09	17:20117	OSTI; NTIS (US Sales Only); INIS		DE92516501	

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NBL–					
325	17:17895	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013024	MF-406
326	17:18117	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012529	MF-700
NDP–					
039	17:19437	*See* ORNL/CDIAC–47			
NDRL–					
3487	17:19044	*See* DOE/ER/00038–3487			
NEA/NEACRP/R–					
91-2	17:20493	OSTI; NTIS (US Sales Only); INIS		DE92517872	
NEANDC(E)–					
246/L	17:20195	OSTI; NTIS (US Sales Only)		DE92011702	
NEDO-P–					
9089	17:18237	OSTI; NTIS (US Sales Only)		DE92514609	
NEI-DK–					
770	17:19826	OSTI; NTIS (US Sales Only)		DE92506314	
774	17:18702	OSTI; NTIS (US Sales Only)		DE92506315	
779	17:18703	OSTI; NTIS (US Sales Only)		DE92506308	
780	17:19426	OSTI; NTIS (US Sales Only)		DE92506309	
781	17:18704	OSTI; NTIS (US Sales Only)		DE92506306	
782	17:18705	OSTI; NTIS (US Sales Only)		DE92506305	
783	17:18706	OSTI; NTIS (US Sales Only)		DE92506307	
784	17:17882	OSTI; NTIS (US Sales Only)		DE92506313	
785	17:18143	OSTI; NTIS (US Sales Only)		DE92506304	
794	17:18949	OSTI; NTIS (US Sales Only); INIS		DE92627809	
795	17:19427	OSTI; NTIS (US Sales Only)		DE92506328	
796	17:18707	OSTI; NTIS (US Sales Only)		DE92506333	
797	17:18265	OSTI; NTIS (US Sales Only)		DE92506334	
798	17:18790	OSTI; NTIS (US Sales Only)		DE92506327	
799	17:19428	OSTI; NTIS (US Sales Only)		DE92506339	
800	17:19429	OSTI; NTIS (US Sales Only)		DE92506338	
801	17:18162	OSTI; NTIS (US Sales Only)		DE92506336	
802	17:18708	OSTI; NTIS (US Sales Only)		DE92506337	
803	17:19526	OSTI; NTIS (US Sales Only); INIS		DE92627849	
804	17:19430	OSTI; NTIS (US Sales Only)		DE92506329	
805	17:18163	OSTI; NTIS (US Sales Only)		DE92506335	
806	17:18248	OSTI; NTIS (US Sales Only)		DE92506343	
807	17:19037	OSTI; NTIS (US Sales Only)		DE92506345	
808	17:17883	OSTI; NTIS (US Sales Only)		DE92506341	
809	17:18285	OSTI; NTIS (US Sales Only); INIS		DE92506344	
810	17:18751	OSTI; NTIS (US Sales Only)		DE92506342	
811	17:18595	OSTI; NTIS (US Sales Only)		DE92506377	
812	17:18596	OSTI; NTIS (US Sales Only)		DE92506381	
813	17:18266	OSTI; NTIS (US Sales Only)		DE92506357	
814	17:18668	OSTI; NTIS (US Sales Only)		DE92506352	
815	17:18214	OSTI; NTIS (US Sales Only)		DE92506386	
816	17:18249	OSTI; NTIS (US Sales Only)		DE92506356	
817	17:18791	OSTI; NTIS (US Sales Only)		DE92506383	
818	17:18792	OSTI; NTIS (US Sales Only)		DE92506382	
819	17:18650	OSTI; NTIS (US Sales Only)		DE92506385	
820	17:18651	OSTI; NTIS (US Sales Only)		DE92506387	
821	17:18652	OSTI; NTIS (US Sales Only)		DE92506388	
822	17:18635	OSTI; NTIS (US Sales Only)		DE92506380	
823	17:18793	OSTI; NTIS (US Sales Only)		DE92506373	
824	17:18653	OSTI; NTIS (US Sales Only)		DE92506460	
825	17:18164	OSTI; NTIS (US Sales Only)		DE92506372	
826	17:18278	OSTI; NTIS (US Sales Only)		DE92506462	
827	17:19558	OSTI; NTIS (US Sales Only)		DE92506395	
828	17:19431	OSTI; NTIS (US Sales Only)		DE92506394	
829	17:18730	OSTI; NTIS (US Sales Only)		DE92506393	
830	17:18669	OSTI; NTIS (US Sales Only)		DE92506468	
831	17:18196	OSTI; NTIS (US Sales Only); INIS		DE92506465	
832	17:18670	OSTI; NTIS (US Sales Only)		DE92506466	
833	17:18254	OSTI; NTIS (US Sales Only)		DE92506467	
834	17:18800	OSTI; NTIS (US Sales Only)		DE92506389	
835	17:18794	OSTI; NTIS (US Sales Only)		DE92506469	
836	17:20325	OSTI; NTIS (US Sales Only); INIS		DE92628746	
840	17:18267	OSTI; NTIS (US Sales Only)		DE92506471	
841	17:18198	OSTI; NTIS (US Sales Only)		DE92506472	
842	17:18283	OSTI; NTIS (US Sales Only); INIS		DE92506461	
NEI-FI–					
153	17:17715	OSTI; NTIS (US Sales Only)		DE92506476	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
154	17:18024	OSTI; NTIS (US Sales Only); INIS		DE92628316	
NEI-NO–					
192	17:20282	OSTI; NTIS (US Sales Only); INIS		DE92628654	
193	17:19821	OSTI; NTIS (US Sales Only); INIS		DE92628100	
194	17:19822	OSTI; NTIS (US Sales Only); INIS		DE92628101	
196	17:19912	OSTI; NTIS (US Sales Only); INIS		DE92628035	
197	17:19913	OSTI; NTIS (US Sales Only); INIS		DE92628040	
198	17:19432	OSTI; NTIS (US Sales Only); INIS		DE92627917	
199	17:18752	OSTI; NTIS (US Sales Only)		DE92506525	
200	17:17848	OSTI; NTIS (US Sales Only)		DE92506526	
201	17:18753	OSTI; NTIS (US Sales Only)		DE92506527	
202	17:20575	OSTI; NTIS (US Sales Only)		DE92506528	
203	17:17881	OSTI; NTIS (US Sales Only); INIS		DE92506529	
204	17:18625	OSTI; NTIS (US Sales Only)		DE92506540	
205	17:18218	OSTI; NTIS (US Sales Only)		DE92506542	
206	17:18795	OSTI; NTIS (US Sales Only)		DE92506543	
207	17:18230	OSTI; NTIS (US Sales Only)		DE92506544	
208	17:18582	OSTI; NTIS (US Sales Only)		DE92506545	
209	17:17849	OSTI; NTIS (US Sales Only)		DE92506546	
210	17:18647	OSTI; NTIS (US Sales Only)		DE92506547	
211	17:19433	OSTI; NTIS (US Sales Only)		DE92506548	
212	17:18685	OSTI; NTIS (US Sales Only)		DE92506549	
213	17:18626	OSTI; NTIS (US Sales Only)		DE92506550	
214	17:18627	OSTI; NTIS (US Sales Only); INIS		DE92506551	
215	17:19949	OSTI; NTIS (US Sales Only)		DE92506559	
216	17:17837	OSTI; NTIS (US Sales Only)		DE92506560	
217	17:19127	OSTI; NTIS (US Sales Only)		DE92506561	
218	17:19527	OSTI; NTIS (US Sales Only)		DE92506563	
NEI-SE–					
94	17:19559	OSTI; NTIS (US Sales Only)		DE92506616	
NIFS–					
122	17:20453	OSTI; NTIS (US Sales Only); INIS		DE92514939	
123	17:20408	OSTI; NTIS (US Sales Only); INIS		DE92514940	
NIPER–					
573	17:17838	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001035	PC-122
575	17:17830	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001037	PC-122
581	17:17831	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001036	PC-122
583	17:17839	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001039	PC-122
593	17:17840	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011498	MF-122; MF-125
NPL-RSA(EXT)–					
18	17:19914	OSTI; NTIS (US Sales Only); INIS		DE92626192	
19	17:19915	OSTI; NTIS (US Sales Only); INIS		DE92626193	
20	17:19010	OSTI; NTIS (US Sales Only); INIS		DE92625278	
NREL/TP–					
210-4469	17:18238	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015013	MF-270
411-4840	17:18239	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001244	MF-271
413-4835	17:18240	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001242	MF-273
451-4751	17:18241	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001223	MF-271
451-4797	17:18242	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001239	MF-273
NRRI–					
92-5	17:18660	OSTI; National Regulatory Research Institute, 1080 Carmack Rd., Columbus, OH 43210		TI92013048	
NSS/G–					
116	17:18025	OSTI; NTIS (US Sales Only); INIS		DE92628334	
NSS/R–					
241	17:18026	OSTI; NTIS (US Sales Only); INIS		DE92628335	
263	17:18027	OSTI; NTIS (US Sales Only); INIS		DE92628336	
NUREG–					
0090-Vol.14-No.4	17:18432	OSTI; NTIS; INIS; GPO		TI92012652	
0304-Vol.16-No.4	17:18349	OSTI; NTIS; GPO		TI92011865	
0540-Vol.14-No.2	17:18350	OSTI; NTIS; INIS; GPO		TI92012191	
0544-Rev.3	17:18644	OSTI; NTIS; INIS; GPO		TI92012431	
0750-Vol.35-No.2	17:18351	OSTI; NTIS; GPO; INIS		TI92013203	
0837-Vol.11-No.4	17:19434	OSTI; NTIS; GPO		TI92011649	
0910-Rev.2	17:20626	OSTI; NTIS; INIS; GPO		TI92012213	
1125-Vol.13	17:18433	OSTI; NTIS; INIS		TI92013019	
1266-Vol.6	17:18434	OSTI; NTIS; INIS; GPO		TI92013509	
1414	17:20519	OSTI; NTIS; GPO		TI92012234	
1419	17:19090	OSTI; NTIS; INIS; GPO		TI92013218	

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
NUREG/CR–					
2000-Vol.11-No.2	17:18352	OSTI; NTIS; INIS; GPO		TI92011657	
4599-Vol.1-No.2	17:18367	OSTI; NTIS; INIS; GPO		TI92010715	
4831	17:18542	OSTI; NTIS; INIS; GPO		TI92010928	
5604-Vol.2	17:18543	OSTI; NTIS; INIS; GPO		TI92013991	
5631-Rev.1	17:19916	OSTI; NTIS; INIS; GPO		TI92011387	
5633	17:18544	OSTI; NTIS; INIS; GPO		TI92013014	
5731	17:19950	OSTI; NTIS; INIS; GPO		TI92012158	
5732	17:18391	OSTI; NTIS; INIS; GPO		TI92012657	
5785	17:18368	OSTI; NTIS; INIS; GPO		TI92012159	
5797	17:19917	OSTI; NTIS; INIS; GPO		TI92011608	
5815	17:18341	OSTI; NTIS; INIS; GPO		TI92011579	
5821	17:18545	OSTI; NTIS; INIS; GPO		TI92012540	
5841	17:18546	OSTI; NTIS; INIS; GPO		TI92011388	
5855	17:18547	OSTI; NTIS; INIS; GPO		TI92012260	
NUREG/IA–					
0027	17:18548	OSTI; NTIS; INIS; GPO		TI92012255	
0036	17:18549	OSTI; NTIS; INIS; GPO		TI92012318	
0037	17:18550	OSTI; NTIS; INIS; GPO		TI92011698	
0038	17:18551	OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020		TI92012511	
0041	17:18552	OSTI; NTIS; INIS; GPO		TI92011648	
0043	17:18553	OSTI; NTIS; INIS; GPO		TI92012226	
0056	17:18303	OSTI; NTIS; INIS; GPO		TI92010444	
0057	17:18554	OSTI; NTIS; INIS; GPO		TI92012680	
0058	17:18555	OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020		TI92013505	
0059	17:18556	OSTI; NTIS; INIS; GPO		TI92013004	
0069	17:18557	OSTI; INIS; GPO; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020		TI92013518	
0070	17:18558	OSTI; GPO; INIS; NTIS		TI92013437	
NUTEK–					
89-4705	17:19560	OSTI; NTIS (US Sales Only); INIS		DE92506603	
90-4054	17:18754	OSTI; NTIS (US Sales Only)		DE92506604	
91-702	17:18755	OSTI; NTIS (US Sales Only)		DE92506605	
NUTEK-A-B–					
92-1	17:18199	OSTI; NTIS (US Sales Only)		DE92506588	
NUTEK-B–					
91-1	17:18671	OSTI; NTIS (US Sales Only)		DE92506577	
91-6	17:18586	OSTI; NTIS (US Sales Only)		DE92506585	
91-7	17:18661	OSTI; NTIS (US Sales Only)		DE92506586	
91-8	17:18657	OSTI; NTIS (US Sales Only)		DE92506600	
92-1	17:18133	OSTI; NTIS (US Sales Only)		DE92506587	
NUTEK-FBT–					
92-1	17:17801	OSTI; NTIS (US Sales Only); INIS		DE92506602	
92-6	17:19435	OSTI; NTIS (US Sales Only)		DE92506589	
NUTEK-KOL–					
92-1	17:17776	OSTI; NTIS (US Sales Only)		DE92506601	
NUTEK-VIND–					
92-1	17:18261	OSTI; NTIS (US Sales Only)		DE92506590	
NYSERDA–					
91-13	17:18709	OSTI; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI92011539	
92-1	17:18589	OSTI; INIS; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI92011540	
92-2	17:18151	OSTI; INIS; New York State Energy Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI92011541	
OCS/MMS–					
91-0068	17:17841	OSTI; US Department of the Interior, Minerals Management Service, MS-4610, 381 Elden St., Herndon, VA 22070-4817		TI92012430	
OEFZS–					
4596	17:18672	OSTI; NTIS (US Sales Only); INIS		DE92626261	
4602	17:18304	OSTI; NTIS (US Sales Only); INIS		DE92626909	
4610	17:18129	OSTI; NTIS (US Sales Only); INIS		DE92626791	

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
4611	17:18130	OSTI; NTIS (US Sales Only); INIS		DE92626792	
4614	17:19528	OSTI; NTIS (US Sales Only); INIS		DE92625796	
4617	17:19918	OSTI; NTIS (US Sales Only); INIS		DE92626083	
ORNL-MIT–					
124	17:19529	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013030	MF-402
ORNL/CDIAC–					
46	17:19436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011733	MF-402
47	17:19437	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010378	MF-402
ORNL/ER–					
23	17:18028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012589	MF-902
25	17:18029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012591	MF-902
ORNL/M–					
2001	17:18892	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011503	MF-404
ORNL/NSIC–					
200-Vol.11-No.2	17:18352	*See* NUREG/CR–2000-Vol.11-No.2			
ORNL/TM–					
11553	17:20576	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012414	
11730	17:19530	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013161	MF-402
11861	17:18391	*See* NUREG/CR–5732			
11882	17:19919	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011502	MF-407
11882-Absts.	17:19920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011594	MF-407
11950	17:18368	*See* NUREG/CR–5785			
12029	17:19936	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013304	
12054	17:19823	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012619	MF-408
12065	17:20594	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013351	MF-405
ORO–					
2412-110	17:19937	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011569	MF-408
OUP–					
91-29	17:20196	OSTI; NTIS (US Sales Only); INIS		DE92628578	
91-31	17:20520	OSTI; NTIS (US Sales Only); INIS		DE92628417	
92-01	17:20018	OSTI; NTIS (US Sales Only); INIS		DE92628449	
92-02	17:19327	OSTI; NTIS (US Sales Only); INIS		DE92628293	
PATENTS-					
	17:17833	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17842	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17845	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17846	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17847	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17862	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17864	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17869	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17870	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
	17:17871	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17872	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17873	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17888	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17889	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:17891	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18168	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18215	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18231	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18245	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18591	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18683	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18720	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18721	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18722	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18802	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18803	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18804	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
	17:18806	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:18808	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:19115	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:19123	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:19124	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:19125	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	17:19449	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
PCCF-RI–					
91-04	17:19328	OSTI; NTIS (US Sales Only); INIS		DE92517869	
91-07	17:19329	OSTI; NTIS (US Sales Only); INIS		DE92517868	
PEL–					
299	17:18305	OSTI; NTIS (US Sales Only); INIS		DE92626910	
300	17:18383	OSTI; NTIS (US Sales Only); INIS		DE92626866	
304	17:18306	OSTI; NTIS (US Sales Only); INIS		DE92626911	
306	17:19330	OSTI; NTIS (US Sales Only); INIS		DE92626985	
309	17:18357	OSTI; NTIS (US Sales Only); INIS		DE92626845	
310	17:18307	OSTI; NTIS (US Sales Only); INIS		DE92626912	
311	17:18308	OSTI; NTIS (US Sales Only); INIS		DE92626913	
314	17:18358	OSTI; NTIS (US Sales Only); INIS		DE92626914	
315	17:18359	OSTI; NTIS (US Sales Only); INIS		DE92626915	
PHE–					
91-014	17:20119	OSTI; NTIS (US Sales Only); INIS		DE92516790	
91-015	17:19331	OSTI; NTIS (US Sales Only); INIS		DE92517038	
91-09	17:20118	OSTI; NTIS (US Sales Only); INIS		DE92516978	
PITHA–					
91/18	17:20120	OSTI; NTIS (US Sales Only); INIS		DE92516575	
PNL–					
6450-51-HEDR	17:19921	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011492	MF-707
6450-52-HEDR	17:19922	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013442	MF-707
7175	17:18030	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012168	MF-507; MF-510
7206	17:17915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013600	MF-820
7260-HEDR	17:19531	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013016	MF-707
7445-Rev.1	17:19916	*See* NUREG/CR–5631-Rev.1			
7454	17:18544	*See* NUREG/CR–5633			
7474	17:18031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012319	MF-814
7488-Ver.1.0	17:18032	OSTI; NTIS; GPO Dep.	E 1.99:	DE91005213	MF-721; MF-705
7511-Ver.1.0	17:20595	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007890	MF-721; MF-705
7724	17:18545	*See* NUREG/CR–5821			
7757-HEDR-Rev.1	17:19923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012141	MF-707
7776	17:18542	*See* NUREG/CR–4831			
7874	17:19532	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013160	MF-403
7919	17:18756	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011505	MF-310
7920	17:18757	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011504	MF-310
8010	17:18402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012261	MF-704
8028	17:18033	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011510	MF-403
8029	17:18034	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011508	MF-602
8049	17:19438	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011509	MF-402

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
8053	17:19091	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011511	
8057	17:19533	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012618	MF-903
8058	17:18648	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011673	MF-350
8070	17:19534	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013065	MF-403
8076	17:18758	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013599	MF-313
8080	17:18559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013702	MF-402
8083-HEDR	17:19535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012169	MF-707
PNL-SA–					
17467	17:20596	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012351	MF-366
19467	17:18253	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012327	MF-203
19941	17:18035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012326	MF-812
19967	17:18036	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012343	MF-812
19981	17:19332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012347	
20057	17:18037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011282	MF-902
20173	17:17861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010497	MF-502
20212	17:18038	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012342	MF-902
20246	17:20521	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012331	MF-500
20258	17:18039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012346	MF-510
20353	17:18040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012345	MF-510
20358	17:18973	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012353	MF-501
20361	17:18041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012328	MF-510
20362	17:18042	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012563	MF-721
20371	17:18043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012348	MF-814
20380	17:18044	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012349	MF-814
20399	17:19439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012354	
20400	17:18628	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012355	
20510	17:18045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010495	MF-902
20550	17:19536	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012350	MF-940
POEF–					
2094	17:18046	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011647	MF-510
PPPL–					
2835	17:19136	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013244	PC-426; PC-427
2836	17:20409	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013245	PC-427
2837	17:20454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013246	PC-420
2838	17:20410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013247	PC-420
2839	17:20411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013249	PC-420; PC-427
2840	17:20412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013248	PC-420
2841	17:20455	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013638	PC-426
2842	17:20456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014001	PC-420
PPPL-CFP–					
2605	17:20457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012669	MF-421
PR-PHS-P–					
9.	17:20494	*See* AECL–10196			
PR-PHY–					
1.	17:20495	*See* AECL–10332			
2.	17:20496	*See* AECL–10420			
PR-TASCC–					
1.	17:19153	*See* AECL–10337			
2.	17:19154	*See* AECL–10431			
PSI–					
110	17:20458	OSTI; NTIS (US Sales Only); INIS		DE92627510	
PWR-HTWG-P–					
87-496	17:18549	*See* NUREG/IA–0036			
PWR/PKWG/P–					
88-390	17:18555	*See* NUREG/IA–0058			
Q–					
139	17:19044	*See* DOE/ER/00038–3487			
RAL–					
89-050	17:19157	OSTI; NTIS (US Sales Only); INIS		DE92626804	
90-050	17:19158	OSTI; NTIS (US Sales Only); INIS		DE92626805	
91-085	17:20121	OSTI; NTIS (US Sales Only); INIS		DE92627311	
91-090	17:20122	OSTI; NTIS (US Sales Only); INIS		DE92627312	
91-096	17:20326	OSTI; NTIS (US Sales Only); INIS		DE92627520	
92-002	17:20327	OSTI; NTIS (US Sales Only); INIS		DE92628747	
92-004	17:20123	OSTI; NTIS (US Sales Only); INIS		DE92628526	
92-005	17:20054	OSTI; NTIS (US Sales Only); INIS		DE92628485	
92-014	17:20328	OSTI; NTIS (US Sales Only); INIS		DE92628748	
REG/G–					
92013174	17:18353	OSTI; NTIS; INIS		TI92013174	

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RER-K–					
2239-Del.	17:18560	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011596	MF-706
RER-L–					
795-Del.	17:18561	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011595	MF-706
RER-P–					
1865	17:18562	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011619	MF-706
RFP–					
4447-Pt.1-Rev.	17:18893	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012113	MF-704
4447-Pt.2-Rev.	17:18894	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012114	MF-704
4529	17:19354	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013162	PC-706
4565	17:18895	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010949	MF-701
RISO-M–					
2927	17:18262	OSTI; NTIS (US Sales Only); INIS		DE92506340	
2944	17:20522	OSTI; NTIS (US Sales Only); INIS		DE92628418	
RISO-R–					
591	17:20335	OSTI; NTIS (US Sales Only); INIS		DE92628753	
609	17:18384	OSTI; NTIS (US Sales Only); INIS		DE92628190	
RIVM–					
249102006	17:19924	OSTI; NTIS (US Sales Only); INIS		DE92628044	
RT/INN–					
90-12	17:18989	*See* ENEA-RT-INN–90-12			
90-24	17:19042	*See* ENEA-RT-INN–90-24			
90-31	17:20563	*See* ENEA-RT-INN–90-31			
90-34	17:20564	*See* ENEA-RT-INN–90-34			
90-35	17:20445	*See* ENEA-RT-INN–90-35			
90-41	17:18832	*See* ENEA-RT-INN–90-41			
90-43	17:19131	*See* ENEA-RT-INN–90-43			
RT/NUCL–					
90-38	17:19345	*See* ENEA-RT-NUCL–90-38			
RTI-STUDI-ENE–					
91-03	17:18744	*See* ENEA-RTI-STUDI-ENE–91-03			
RTI/DS–					
91-03	17:18600	*See* ENEA-RTI-DS–91-03			
RTI/INN-SVIL–					
91-22	17:18807	*See* ENEA-RTI-INN-SVIL–91-22			
RTI/NUC-IMP–					
91-02	17:19085	*See* ENEA-RTI-NUC-IMP–91-02			
RTR–					
270-R	17:18398	*See* DPSP–60-1816			
480	17:18364	*See* DPSP–63-1192			
866	17:18399	*See* DPSP–66-1367			
RU–					
57-90	17:20298	*See* BNL–47318			
SAIC–					
89/1570-APPAT-115	17:19109	*See* DOE/ER/13911–T2			
SAND–					
88-0585	17:18047	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014170	MF-814
88-1331	17:18048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013768	MF-814
88-7124	17:18049	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013459	MF-814
89-0972/2	17:18050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012615	MF-814
89-2370	17:20597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012281	PC-722
89-7007	17:18051	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013055	MF-814
90-1326	17:19372	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011441	MF-501
90-2882	17:18052	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012685	MF-814
90-3111C	17:19092	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011385	MF-721
91-1173	17:18563	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013679	
91-1299	17:18053	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011517	MF-902
91-1591	17:18974	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012444	MF-704
91-1624	17:19221	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013461	MF-700
91-1626	17:19222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013770	MF-414
91-1634	17:20260	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011518	MF-705
91-1691C	17:19119	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010670	MF-743
91-1704C	17:19093	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010666	MF-706
91-1717C	17:19094	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010663	MF-706; MF-704
91-1730C	17:18054	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012631	MF-814
91-1747	17:18243	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011440	MF-235
91-1977C	17:17916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011184	MF-902
91-2155C	17:19386	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011149	MF-706
91-2203	17:18244	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013680	MF-237
91-2208C	17:19223	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012630	MF-706

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91-2226	17:19917	*See* NUREG/CR–5797			
91-2285C	17:19181	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011380	MF-706
91-2329	17:19378	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92013456	MF-706
91-2343	17:19362	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012449	MF-706
91-2350C	17:19095	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012681	MF-706
91-2459	17:19346	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011514	MF-706
91-2495-Vol.1	17:19363	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011339	
91-2495-Vol.2	17:19364	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011340	
91-2575	17:17832	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013682	MF-126
91-2579	17:19347	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010399	MF-706
91-2664	17:19365	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92013681	MF-700
91-2693C	17:18975	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011658	MF-704; MF-705
91-2695C	17:17771	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006678	MF-113
91-2727C	17:18976	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011381	MF-704
91-2780	17:17917	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011513	MF-722
91-2790C	17:20598	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012632	MF-705
91-2807	17:19137	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013781	MF-706
91-2808C	17:19096	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004360	MF-700
91-2910C	17:19976	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008015	MF-706
91-7093	17:18564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013699	MF-523
91-8230	17:20599	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013394	MF-705
91-8706	17:19038	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005330	MF-401
91-8712	17:19065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005327	MF-411
91-8714	17:19066	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005328	MF-410
91-8715	17:17823	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006465	MF-102
91-8716	17:17824	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006698	MF-104
91-8717	17:17825	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006681	MF-102
91-8718	17:19067	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005326	MF-401
91-8719	17:17772	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006680	MF-104
91-8720	17:19068	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006705	MF-401
91-8721	17:17875	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006679	MF-400
91-8732	17:19069	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006697	MF-401
91-8733	17:19070	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006700	MF-401
91-8742	17:19071	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006682	MF-401
91-8743	17:19072	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006699	MF-401
92-0024	17:19366	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012686	MF-706
92-0046	17:19120	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012616	MF-706
92-0049C	17:20459	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011171	MF-712
92-0065C	17:20261	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011154	MF-706
92-0066C	17:20413	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011153	MF-700
92-0091C	17:18055	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011382	MF-814
92-0117C	17:19224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011379	MF-700
92-0155C	17:20460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010669	MF-712
92-0156C	17:20461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012626	MF-712
92-0189C	17:20414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010775	MF-700
92-0193C	17:19040	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011358	MF-705
92-0211	17:19138	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013291	MF-704
92-0247C	17:18629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011654	MF-940
92-0271C	17:19139	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011659	MF-706
92-0302	17:18056	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92012614	MF-630
92-0323	17:20523	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013676	MF-900
92-0344C	17:19339	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009054	MF-706
92-0357C	17:19340	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003148	
92-0377C	17:19140	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92008328	MF-704
92-0382C	17:19341	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009069	MF-706
92-0384C	17:18977	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010667	MF-704
92-0390C	17:19977	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010959	MF-705
92-0393C	17:18978	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010664	MF-706
92-0404C	17:19367	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92008679	MF-705
92-0407C	17:20524	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012375	MF-700
92-0410	17:19355	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013290	MF-700
92-0448	17:19141	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013457	MF-706
92-0457	17:19097	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92013458	MF-515
92-0460C	17:19387	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011156	MF-706
92-0477C	17:20525	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011139	MF-700
92-0487	17:20526	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013650	MF-700
92-0493	17:19098	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011515	MF-705
92-0518C	17:19356	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011186	MF-706
92-0520C	17:18759	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010957	MF-706
92-0523C	17:18636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011386	MF-201

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92-0532C	17:19537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92009057	MF-802
92-0594C	17:18896	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011761	MF-704
92-0662C	17:19099	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011383	MF-706
92-0736C	17:19142	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011384	MF-704
92-0810C	17:20527	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011664	MF-700
92-0816C	17:19143	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011660	MF-706
92-0864C	17:18950	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012634	MF-704
92-8411C	17:18897	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012143	MF-404
92-8489C	17:20462	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012148	MF-420
92-8495C	17:19011	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012253	MF-401
92-8504C	17:19064	*See* LBL–31590			
SCPRI-RM–					
3-1991	17:19440	OSTI; NTIS (US Sales Only); INIS		DE92517861	
9-1991	17:19441	OSTI; NTIS (US Sales Only); INIS		DE92517862	
SDC–					
92-187	17:19268	*See* ANL/HEP/TR–92/06			
SEI-EED–					
11	17:18649	OSTI; NTIS (US Sales Only)		DE92506569	
SFB–					
210/T-67	17:19442	OSTI; NTIS (US Sales Only)		DE92515868	
SFB-191–					
12-B3-91	17:20415	OSTI; NTIS (US Sales Only); INIS		DE92516968	
SIS–					
1991:10	17:19927	OSTI; NTIS (US Sales Only); INIS		DE92628046	
1991:8	17:19925	OSTI; NTIS (US Sales Only); INIS		DE92628047	
1991:9	17:19926	OSTI; NTIS (US Sales Only); INIS		DE92628048	
SKB-TR–					
91-40	17:19561	OSTI; NTIS (US Sales Only); INIS		DE92627907	
91-41	17:18101	OSTI; NTIS (US Sales Only); INIS		DE92628031	
91-43	17:18057	OSTI; NTIS (US Sales Only); INIS		DE92628337	
91-45	17:19538	OSTI; NTIS (US Sales Only)		DE92506617	
91-47	17:19039	OSTI; NTIS (US Sales Only); INIS		DE92627706	
SKN–					
51	17:19539	OSTI; NTIS (US Sales Only); INIS		DE92625797	
52	17:19540	OSTI; NTIS (US Sales Only); INIS		DE92623495	
SL–					
87835	17:18268	OSTI; NTIS (US Sales Only)		DE92506390	
SLAC-PUB–					
5649	17:19225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011520	MF-414
5732	17:19955	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011582	MF-410
5745	17:19333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012415	MF-414
5747	17:19182	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012416	MF-414
5752	17:19967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011583	MF-414
5760	17:19226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012417	MF-414
5764	17:19227	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010746	MF-414
5766	17:19183	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011584	MF-414
5768	17:19228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012418	MF-414
5775	17:19229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012419	MF-414
5780	17:19230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010751	MF-414
5781	17:19184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011585	MF-414
5782	17:19231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011586	MF-414
5784	17:19185	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010752	MF-414
5789	17:19186	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012420	MF-414
5793	17:19334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012421	MF-414
5804	17:19187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012424	MF-414
5806	17:19232	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012422	MF-414
SNO–					
87-5.	17:19264	*See* AECL–9433			
SNV–					
3982	17:18165	OSTI; NTIS (US Sales Only)		DE92506576	
SP–					
91-35	17:19562	OSTI; NTIS (US Sales Only)		DE92506619	
SR/CNEAF–					
92-01	17:18058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011250	MF-950
SRI-ENV–					
92-14-7375	17:17795	*See* DOE/PC/90365–T4			
SRP-HP–					
51	17:19541	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011212	MF-707
SSCL–					
530	17:19188	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013299	PC-400
561	17:19233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011767	MF-414

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
570	17:19189	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013744	PC-414
SSCL-Preprint–					
72	17:19190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011696	MF-414
74	17:19234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011697	MF-414
75	17:19235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011695	MF-414
76	17:19236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011694	MF-414
78	17:19237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011693	MF-414
79	17:19238	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011650	MF-414
80	17:19239	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011692	MF-414
85	17:19184	*See* SLAC-PUB–5781			
SSDC–					
4-Rev.3	17:20507	*See* DOE/SSDC–76-45/4-Rev.3			
SSS-R–					
87-8437	17:18061	*See* UCRL-CR–109641			
88-8687	17:19379	*See* UCRL-CR–109639			
STRIPA-TR–					
91-13	17:19542	OSTI; NTIS (US Sales Only); INIS		DE92627869	
91-20	17:18102	OSTI; NTIS (US Sales Only); INIS		DE92627870	
91-21	17:18979	OSTI; NTIS (US Sales Only); INIS		DE92627833	
91-22	17:18103	OSTI; NTIS (US Sales Only); INIS		DE92627871	
91-23	17:19543	OSTI; NTIS (US Sales Only); INIS		DE92627872	
91-24	17:18980	OSTI; NTIS (US Sales Only); INIS		DE92627834	
91-25	17:18104	OSTI; NTIS (US Sales Only); INIS		DE92627873	
STU–					
87-3808	17:18898	OSTI; NTIS (US Sales Only)		DE92506591	
STUDSVIK-NS–					
91-60.	17:18101	*See* SKB-TR–91-41			
STUDSVIK/NP–					
87/63	17:18550	*See* NUREG/IA–0037			
88/101	17:18551	*See* NUREG/IA–0038			
SV-U–					
91-48	17:18662	OSTI; NTIS (US Sales Only)		DE92506570	
SV-UB–					
91-62	17:18279	OSTI; NTIS (US Sales Only)		DE92506568	
91-66	17:18134	OSTI; NTIS (US Sales Only)		DE92506571	
SV-UD–					
91-56	17:18269	OSTI; NTIS (US Sales Only)		DE92506567	
SV-UE–					
91-63	17:18663	OSTI; NTIS (US Sales Only)		DE92506572	
SV-UG–					
91-60	17:17850	OSTI; NTIS (US Sales Only)		DE92506566	
TKK-F–					
A623	17:18590	OSTI; NTIS (US Sales Only)		DE92506508	
A669	17:18250	OSTI; NTIS (US Sales Only)		DE92506509	
TKK-KO/LTK–					
66	17:18681	OSTI; NTIS (US Sales Only)		DE92506506	
67	17:18682	OSTI; NTIS (US Sales Only)		DE92506507	
TKK-V–					
C110	17:18760	OSTI; NTIS (US Sales Only)		DE92506510	
TPRD/L–					
3209/R87	17:18549	*See* NUREG/IA–0036			
TRITA-ALF–					
91-01	17:20416	OSTI; NTIS (US Sales Only); INIS		DE92628696	
91-02	17:20417	OSTI; NTIS (US Sales Only); INIS		DE92628706	
91-03	17:20463	OSTI; NTIS (US Sales Only); INIS		DE92628721	
TRITA-EPP–					
91-03	17:19978	OSTI; NTIS (US Sales Only); INIS		DE92627927	
91-04	17:20418	OSTI; NTIS (US Sales Only); INIS		DE92628702	
TSL/ISV–					
91-0055	17:20081	*See* DESY–92-014			
TTC–					
0943	17:20597	*See* SAND–89-2370			
1039	17:19092	*See* SAND–90-3111C			
1091	17:17916	*See* SAND–91-1977C			
UCB-PTH–					
91/52	17:20194	*See* LBL–31382			
UCMFT–					
10/91	17:20076	*See* DESY–92-005			
UCRL–					
102612	17:18131	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011851	MF-712
21203-Vol.3	17:19144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011442	MF-712

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
21215-91-Add.A	17:18059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013512	MF-702; MF-721
21215-91-Add.B	17:18060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012679	MF-702
52000-91-11	17:19100	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011739	PC-700
52000-91-12	17:19443	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013595	PC-700
53779-88	17:19544	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012423	PC-403
UCRL-CR–					
103698	17:19348	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011766	
104380-Rev.1	17:20481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011292	MF-422
107774	17:20421	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010437	MF-422
109223	17:20262	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011290	MF-700
109261	17:19928	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011291	MF-707
109550	17:20482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011967	MF-712; MF-705
109602	17:20483	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013010	MF-706
109639	17:19379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010439	MF-701
109641	17:18061	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010443	MF-703
110002	17:19979	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013039	MF-706
110115	17:19388	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011847	MF-706
110157	17:20422	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011945	MF-905
110256	17:19373	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013517	MF-706
110424	17:20629	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013067	MF-705
UCRL-ID–					
104916	17:19563	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011590	MF-702
105340	17:19545	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012395	MF-802
107571	17:19101	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011737	MF-406
109127	17:19102	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012394	MF-603
109283	17:19240	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012410	MF-706
109373	17:18981	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011588	MF-504
109860	17:18731	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012409	MF-702
110116	17:19824	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011591	MF-706
110194	17:19145	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012397	MF-712
110428	17:18899	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013262	MF-706
UCRL-JC–					
103243-Rev.2	17:19980	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011469	MF-700
103782-Rev.1	17:19146	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011521	MF-706
104099	17:20484	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011524	MF-700
104516	17:18982	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011390	MF-704
104580	17:19981	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011522	MF-706
104592	17:18900	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011395	MF-404
104651	17:20276	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92009114	MF-700
104837	17:19951	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011460	MF-703
104964	17:20205	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011396	MF-410
105226	17:19335	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011523	MF-706
105233	17:18983	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011462	MF-706; MF-704
105234	17:19336	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011464	MF-706
105269	17:19380	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011973	MF-741
105329	17:18901	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011463	MF-706
106149	17:18902	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013006	MF-404
106761	17:19114	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011408	MF-700
106802	17:20485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010438	MF-410
106910-Rev.1	17:18216	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008933	MF-701
107317	17:18984	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011962	MF-704
107393	17:19546	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010717	MF-402
107399	17:19368	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011947	MF-706
107443	17:19982	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011732	MF-706
107696	17:18903	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011528	MF-400
107745	17:19147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010714	MF-700
107793	17:18904	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011530	MF-704
107865	17:20600	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011466	MF-706
107866	17:18905	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011467	MF-706
107883	17:18906	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011468	MF-706
107901	17:18062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011535	MF-721
108127	17:19148	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012695	MF-712
108146	17:19149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011763	MF-712
108315	17:19952	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011527	MF-403
108503	17:19103	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010440	
108515	17:20601	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011294	MF-705
108548	17:20602	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011948	MF-705; MF-706

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108606	17:18907	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011046	MF-404
108728	17:18908	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012677	
108738	17:18985	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011848	MF-706
108753	17:20296	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011525	MF-700
108838	17:18909	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011526	MF-704
108959	17:18565	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011300	MF-700
108960	17:18345	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011297	MF-700
108973	17:20603	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011299	MF-705
108974	17:20423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011296	MF-420
108985	17:19374	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012101	MF-741
108986	17:19375	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011298	MF-700
108993	17:20604	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011295	MF-705
109000	17:20270	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006596	MF-404
109001	17:20297	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011470	MF-704
109004	17:18602	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011534	MF-702
109024	17:18910	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010705	MF-704
109055	17:19073	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008563	MF-700
109083	17:19074	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008553	MF-700
109095	17:20424	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013207	MF-712
109210	17:17773	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011532	MF-108
109219	17:19349	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011949	MF-706
109222	17:19983	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011850	MF-700
109224	17:18810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011529	MF-700
109225	17:20605	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011963	MF-705
109251	17:20606	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008068	MF-705
109266	17:20607	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008076	MF-705
109268	17:18911	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011764	MF-712
109337	17:20486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012694	MF-706
109389	17:19150	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011849	MF-704
109496	17:20608	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008073	MF-705
109501	17:19953	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011389	MF-402
109505	17:20609	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007300	MF-705
109517	17:20487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011964	MF-423
109522	17:20488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011965	MF-712
109627	17:20336	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011533	MF-400
109659	17:20610	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008062	MF-705
109672	17:19241	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012678	MF-706
109673	17:18801	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009690	MF-362
109718	17:19369	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011329	MF-700
109754	17:18111	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011287	MF-702; MF-706
109756	17:19075	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009457	MF-701
109757	17:19076	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007902	MF-700
109774	17:20611	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010716	MF-405
109808	17:20489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010718	MF-700
109811	17:20490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010719	MF-705
109816	17:20491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011944	MF-420
109817	17:19370	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011917	MF-705
109830	17:19444	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011969	MF-702
109840	17:19371	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92011971	
109859	17:19984	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011961	MF-700
109918-Rev.1	17:19104	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010712	MF-712
110087	17:19985	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010720	MF-700
110134	17:19337	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011762	MF-712
110152	17:18986	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012697	MF-706
110158	17:19151	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011946	MF-712
110159	17:20337	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012698	MF-406
110189	17:20283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011760	MF-701
110303	17:19986	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013443	MF-700
UCRL-LR–					
103220-Vol.3	17:20612	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012232	MF-405
105199-91	17:19445	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012613	PC-700; PC-702
109230	17:18912	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012565	PC-704
109425	17:18913	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011651	MF-706; MF-704
109428	17:19105	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011653	MF-706
109625	17:18630	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011816	PC-830
109666	17:20613	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011731	MF-705
109784	17:19106	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013393	PC-706

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UCRL-MA–					
107572	17:19357	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011445	MF-706
108721	17:20614	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE92011444	MF-705
UM-TH–					
91-31	17:20023	*See* FNAL/C–91/335-A			
UMG-DGEN–					
92-1	17:20632	OSTI; NTIS (US Sales Only); INIS		DE92628384	
UR–					
228	17:20263	*See* DOE/DP/40200–196			
USGS-OFR–					
91-105	17:19954	OSTI; INIS; US Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225-0425		TI92011882	MF-814
91-367	17:18064	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011869	
USGS/OFR–					
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DE92515359	ENET–9100228/1	DE92517863	CEA-DAS–747	DE92626843	AECL–10461
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